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World Aviation and Geography

Address to The Geographical Association

THE RT. HON. LORD NATHAN
P.C., T.D., F.S.A., D.L.

President 1956

THE STRONGEST REMINDER I have had of the close connection between aviation and geography came in an agitated phone call I received as Minister of Civil Aviation. B.O.A.C. had flown a Tudor to Nairobi for testing but the operators found that the aircraft could not take off once it had touched down. Their calculations had completely neglected the fact that Nairobi is 5,500 feet up and that, in the thin air at this height, the Tudor needed a longer runway than the local airfield possessed.

I could, of course, go on to give many more serious examples of the way in which physical and economic geography restricts aviation; the economic map, with its control of the demand for air services, is the main determinant of the pattern of civil air routes; and every new service needs long and costly surveys of relevant geographical conditions before it goes into operation. But a more rewarding theme for this address is the way that aviation changes geography. Applied to exploration, topographical mapping and other forms of survey, aviation expands and deepens our knowledge, and helps us to use our environment wisely. Aviation is also a direct force in economic production. Finally, by creating space relationships and developing regional economies, aviation is bringing new values on to the world map. It seems to me that the rapid growth of aviation both offers valuable research techniques and poses to geographers the challenge of making their subject dynamic enough to interpret changing conditions. If they can succeed in assessing the whole consequences of aviation to the world and its people they will do a job no-one else will attempt.

This afternoon I shall pick out examples of aviation applied to exploration and surveys; aviation applied to production; and aviation transforming regional geography.

I

Much of our attention is now fixed on advances in Antarctic exploration. The American and Russian expeditions contributing to the International Geophysical Year are using aircraft extensively for carrying their parties to the Antarctic and supplying them. The

➤ Lord Nathan delivered his address at the House of the Royal Geographical Society, London, on 1st January 1956, during the Annual Conference of the Association, at a joint meeting with the Royal Geographical Society and the Institute of British Geographers.

Americans recently established a party relying solely on air support at the South Pole itself, and the U.S.S.R. is expected to do the same at the South Magnetic Pole. There is little doubt that they will overcome technical difficulties caused by Antarctic weather and the 8,000 foot altitude of the polar plateau. We can expect to learn much from these expeditions in coming months.

Aircraft are also prominent in the organization of the great adventure of the Commonwealth Trans-Antarctic Expedition. On its first phase, which began when the *Theron* left England in November 1955, the expedition took two Auster Mk. 7 aircraft of the R.A.F. Trans-Antarctic flight commanded by Squadron Leader John Lewis. One plane was kept in reserve throughout. The other was assembled at South Georgia and was modified to take either floats or skis. This plane served as the expedition's eye in guiding the *Theron* through the sea ice and in selecting the position of Shackleton Base.

If this year's trans-continental party is to succeed it was essential that Shackleton should be located at a place with reasonable access to the interior. The decision to set up the base in Vahsel Bay area was taken in the light of information gathered by air reconnaissance. There are two mountain ranges inland rising to 4,500 and 6,000 feet respectively. These are considerable obstacles to travel southward but the expedition should succeed in finding a way through or round them.

The *Magga Dan* is carrying two aircraft on the second phase of the expedition: an Auster ski-float plane for ice reconnaissance and carrying glaciologists and other scientists on local exploration around Vahsel Bay; and a De Havilland Otter for long-range reconnaissance and depot laying. The Otter is a very tough machine indeed. It has a range up to 1,400 miles and can carry about a ton of freight. It will greatly assist laying Depot 300 at a place accessible to the trans-continental party on its way to the pole, and will probably land fuel dumps further on. When the trans-continental party leaves Shackleton it is planned to fly over them with the Otter, which will be available to go to their aid if they get into difficulties. The New Zealand party at Scott Base will have an Auster and a De Havilland Beaver, similar to but smaller than the Otter. Thus every stage of the expedition involves air support and success will depend substantially on how effective this support is.

II

Geography is equally being enriched by airborne surveys. The advantages of these techniques arise simply from the view of wide expanses of ground to be seen from an aircraft in flight and the possibility of making a permanent record of this on photographs. From the vertical photograph, in particular, has stemmed the immense range of topographic, historical, land-use and resource surveys to which I wish to draw your attention next.

The best established use of air survey is, of course, in topographic mapping. This method is extremely flexible: accuracy can be varied from the reconnaissance information assembled on an uncontrolled air mosaic to the rigorous requirements of engineering plans. Its speed means that it is particularly suited for use in the many parts of the world where accurate maps do not exist.

The first systematic survey by air photography of Antarctica is now being done as part of the Falkland Islands Dependencies Survey. The aim is to map 50,000 square miles of the Graham Land Peninsula and islands around, and to make a geological reconnaissance using an airborne magnetometer. In the first survey season of the 1955–6 Antarctic summer, bad weather kept usable air photography down to 1,000 square miles but operations were valuable in adapting techniques to Antarctic conditions.

The survey used both amphibious aircraft and helicopters. Two Cansos were converted for the job in Canada and based on Deception Island. Some form of flying boat was essential, but the danger of drifting ice and blizzards meant that the planes might have to be beached at any moment. The Cansos flew at 15,000 feet and 18 miles of country appeared on each photograph.

Two Westland Sikorski helicopters were based on the expedition's ship the *Olaf Sven*. The helicopters had the three main jobs of ice spotting for the ship, of carrying surveyors to points chosen for ground mapping, and of carrying drums to make survey cairns.

The helicopters were particularly valuable in surmounting the shelf glaciers and terminal ice cliffs which, in the past, had prevented landing on many parts of the Graham Land coast. The use of helicopters saved many hours of foot-slogging and climbing under arduous conditions. These operations in Graham Land are a spectacular example of the way aviation has revolutionized techniques of topographic surveying.

III

One of the most fascinating fields of air survey is that of historical geography, in which discoveries have been particularly impressive at archaeological sites where little or nothing can be seen at ground level. Many a Roman villa or abandoned village has been revealed only by skilful air photography in the sunlight of morning or late evening, when long shadows emphasize the lines of banks and ditches. More remarkable still have been discoveries at completely level sites where ancient disturbances of the soil and subsoil, particularly when emphasized by growing crops, may appear as tonal differences on air photographs. These crop and soil marks are often the only indication of a former camp, village, water-course or cultivated area.

Among the triumphs of early air reconnaissance were discoveries like the so-called Celtic fields, the avenue at Stonehenge and Woodhenge

in Wiltshire. Recent results have been summarized by Dr. J. K. St. Joseph in *Recent Archaeological Excavations in Britain.*[1] These include the two Rings on Hutton Moor, near Ripon, ploughed-out barrows of which the more northerly was seen in exceptionally favourable conditions in 1949.

Air photographs of the prehistoric site at Little Woodbury, near Salisbury, led the way to excavation and provided a "blue print" which saved the field workers a great deal of time and effort. The photograph of Silchester, Hampshire, shows a complete Roman town plan from the air. The extent of the Romano-British farming system in the silt fen near Spalding was shown by R.A.F. surveys more than 20 years ago. Many recent photographs have shown up details, for instance, the position of water-courses and ditches outlining roads and farm enclosures and distinguishable from soil works. The deserted medieval village site at Martinsthorpe, Rutland, shows the pattern of house enclosures with sunken roads between. The ridge and furrow pattern of medieval farming is also plainly visible.

IV

Aviation techniques are as important to the economic as to the historical geographer. Interpretation of air photos is prominent in the work of the Commission on World Land Use founded at Lisbon in 1949. A team from the London School of Economics has recently completed excellent 1/50,000 scale land utilization maps[2] of Cyprus from 10,000 R.A.F. photographs.

Appraisal of the world's mineral resources is impeded by the deplorable inadequacy of basic geological mapping in many countries. The time, cost and effort needed for mineralogical investigation can now be reduced by photo-geology, airborne magnetometer, radio-activity and electromagnetic surveys and simply by using helicopters on geological traverses.

Air photography combined with helicopter traversing enabled ten men to map 60,000 square miles of the Canadian north at a scale of four miles to one inch in the summer of 1952. If ground methods had been used the task would have taken 25 years. Furthermore, helicopters actually reduced the cost per unit area of the survey. Planes can also assist actual mining operations. In southwest Tasmania last November a diamond drill and necessary equipment were transported by air in two days; the alternative would have been two months by land.

Airborne techniques are also speeding up research into the world's soil and plant resources and hence the promotion of sound development schemes.

The Canadian government's assistance to Pakistan under the Colombo Plan has taken the form of a resource survey executed by the Photographic Survey Corporation of Toronto with the co-operation

of Pakistani and international scientists. In this project the whole of West Pakistan, an area of 307,000 square miles, was photographed from the air at 1/40,000 scale and mosaics made of the prints. The survey had two aims: (1) a geological survey of Baluchistan; (2) a soil and land-use survey of the Indus Valley.

Baluchistan is an arid country in which photo-geological methods have ample scope. The survey is to result in a 1/250,000 scale geological map and a report suggesting areas suitable for detailed mineral exploration. The investigation followed the normal sequence of collecting all data already in existence and plotting this information on the air mosaics, after which geological interpretation of the photos began. These methods are particularly useful in revealing the major structural features with which minerals are associated. The final stage is field work and the drawing together of all the lines of investigation.

The Indus Valley is to be covered with 1/250,000 scale maps showing the main agricultural soil types with indications of potential use, and separate sheets showing existing land use. The method follows that of the geological survey in assembling existing data, interpretation of the air photos and sampling in the field with the help of helicopters and jeeps: field work was completed in the two seasons 1953–4 and 1954–5.

The urgency of the Indus Valley survey arises from the evil results of irrigation schemes laid out in the past without investigation of soil and other environmental factors. "In consequence huge problems have arisen—waterlogging, deterioration of land by accumulation of salt, soil erosion, silting, unchecked flooding and spread of sandy wastes, to name but a few."[3] The government of Pakistan will now have the reconnaissance information on general soil types, land use and broad salinity conditions essential for guiding development in this potentially rich irrigated area.

Hunting Technical Services Ltd. has completed an important land resource survey of areas in Iraq, using a combination of aerial and ground survey methods to prepare soil and land classification maps and reports, recommendations of changes in farming systems and an assessment of the size of holdings necessary to enable settler families to enjoy a reasonable standard of living. The whole survey was completed in 19 months from the initial study of 1/15,000 scale air photographs to the compilation of reports. No comparable results using ground methods alone could have been achieved in so short a time.

The survey related to four areas soon to be irrigated—Makhmour in the north, Adhaim and Ishaqi north of Baghdad and Nahrwan to the southeast of Baghdad—with a gross area of between 11,000 and 12,000 square kilometres. These areas will be supplied from the Dokan dam. The Iraq Development Board hopes to profit from the sad experience of older irrigation schemes by making environmental studies part of the planning stage of development.

V

My examples of the direct application of aviation to production are drawn from farming. Agricultural aviation is of little relevance to the intensively cultivated fields of Western Europe but is a rapidly growing industry in many countries with extensive farming systems.

In the U.S.A. agricultural aviation is on a grand scale. American aircraft flew 852,000 hours for farming purposes in 1955, 130,000 hours more than in the previous peak year of 1953. The area covered by operators rose to 60 million acres, a good 20 million above 1953. There were 4,419 aircraft specifically approved for pest control work and probably 7,000 planes in agricultural aviation as a whole.

Among Commonwealth countries New Zealand has developed agricultural aviation, and particularly aerial distribution of fertilizers, to a marked degree. Aerial top dressing there is carried out mainly on low hill-country pastures which were formerly forested. After the trees had been felled this land was sown to grass but over-grazing then led to a decline in fertility and to serious soil erosion. The results of applying phosphatic fertilizers are generally good, but this work fell off during the labour shortage of the 1939–45 war, when the carrying capacity of some farms fell to an uneconomic level because of deterioration in pastures and reversion to scrub and fern.

The time was ripe for a new approach to the problem of distributing fertilizers and the first trials of aerial top dressing, organized by the Soil Conservation and Rivers Control Council with the New Zealand Air Force in 1948, were eagerly taken up by farmers. The area treated from the air has grown to 3·8 million acres in the year ending 31 March 1956, representing substantial progress to the ultimate aim of covering 10 million acres of hill-country. More than sixty firms are now in the business. The annual return to farmers for their expenditure is estimated at £5 million and the improvement to land at £25 million. There is also a large indirect benefit from controlling erosion and flooding.

In contrast, agricultural aviation is little developed in Australia. But the Air Beef scheme operating in the Kimberleys is a pointer to the way air freight services can aid farming in a pioneer area.

The Kimberleys lie within a 300-mile radius of Wyndham in the extreme north of Western Australia. The density of population rarely rises above an average of one person to 500 square miles. There are only 50 miles of all-weather roads—in the towns of Derby and Wyndham. Settlement depends basically on cattle-rearing, but remoteness from the main consuming markets has meant that the Kimberley pastures are carrying a cattle population far below their physical capabilities, and that many of the area's cattle are never marketed at all.

By traditional methods the Kimberley farmer has two general possibilities in marketing his cattle. He may walk his stock to the north-western ports of Wyndham, Derby or Broome over a distance of anything

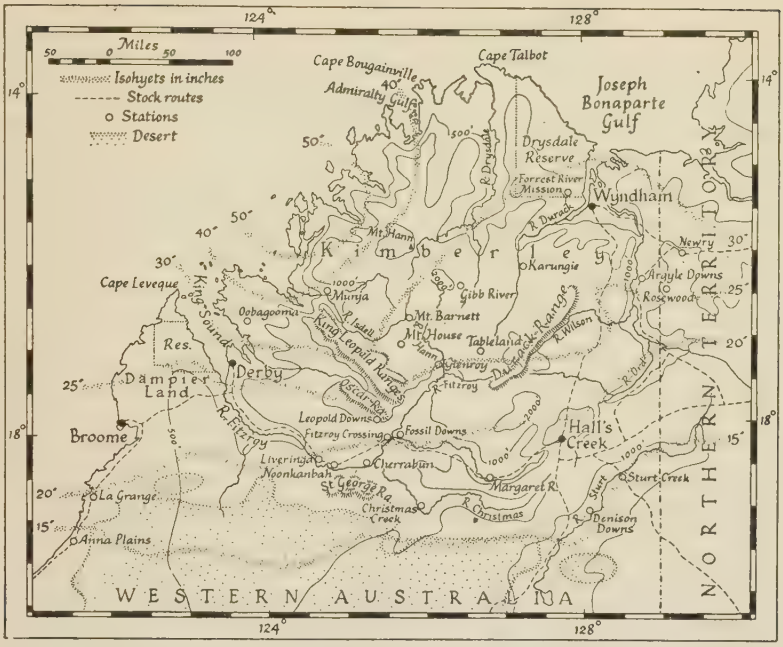

Fig. 1.—The Kimberley area of Western Australia. (Reproduced by permission of the Royal Geographical Society.)

up to 400 miles. The alternative is the route to the east coast— a distance of 1,200 miles, followed by over 600 miles of rail transport.

On the first method the time from the cattle muster to arrival at the coastal meat works averages 51 days; the quality of the animal suffers over the walk and the loss of weight amounts to about 80 lb. The walk to east coast abattoirs lasts some 200 days and, with periods for rest, the whole journey may take a year. The traditional pattern of a long walk to killing at the coast is reversed by the Air Beef method in which the cattle are slaughtered at small inland abattoirs and the meat flown for shipment on the coast in a little over three days from the start of the muster on the home pastures.

In 1949 Air Beef Limited set up an experimental abattoir at Glenroy, 180 miles inland from Wyndham, with a capacity of 300 cattle each week. Over six years of the scheme an average of 4,000 cattle has been slaughtered annually and the average quality of each beast raised from 23 per cent export grade to 65 per cent export grade, while the total frozen carcass weight has increased by 13 per cent. Numbers of cattle marketed from the Glenroy station have doubled over the period. Carcasses are loaded mechanically on to the plane and unloaded into lorries at the far end. From experience gained so far the supporters of Air Beef claim that beef production can be raised more than six times in each area served by air transport and a small inland abattoir, provided that improvements to fencing, herd management and marketing are also made.

VI

At the opening of this address I reviewed briefly the rôle of aviation in Antarctic exploration. To conclude, I wish to consider the relevance of aviation in changing regional values by reference to the northlands of Asia, Europe and North America. I shall first pick out aspects of aviation significant to the internal development of the Soviet and Canadian north; then turn to the new strategic significance of the Arctic and north polar basin; and finally review the entry of civil aircraft to these areas.

The most important contribution of aviation to the development of the Soviet north is in providing transport which escapes from the limitations of sea ice and difficult land conditions. Aircraft were often the first modern vehicles seen by the natives: according to a *Times* article of 1936 an inhabitant of the Taimyr Peninsula described motor cars as wingless aircraft which run on the ground. As S. S. Kamsnev, chairman of the Arctic Commission, said in 1933: "For the Arctic, with its tremendous unconquered regions and unique natural conditions, air routes take on a special significance." Moreover, aviation offers the chance of maintaining communications in the winter, and since 1945 many flights have been made on a regular winter schedule.

From 1941 the principal west–east line has run from Moscow through Igarka and Tiksi to Anadyr. The Leningrad–Archangel line is one of the oldest civil airlines, while there are also lines from Moscow to Archangel, Leningrad to Murmansk and many less important routes. The three main north–south civil airlines in Siberia, along the Ob, Yenisei and Lena rivers, were first flown in the early 1930's. These greatly reduce travelling time between central western Siberia and the northern coast.

The organization most widely known in northern U.S.S.R. is Glavsemorput (Main Administration for the Northern Sea Route), formed in 1932 with responsibility for developing sea traffic and the general economy. In a decree of 1938 its functions were reduced to littoral areas and enterprises connected with the sea route. In 1953 it was attached to the Ministry of the Maritime and River Fleet, while general responsibility for the economy now belongs to the Administration of the Extreme North. However, Glavsemorput controls much Arctic aviation related to its main task of keeping the Northern Sea Route open to shipping from the end of July to the end of September.

During this short navigation season the ice in the Arctic Ocean is not continuous and air ice-reconnaissance has been strongly developed to find lanes through which ice breakers may guide the shipping convoys. The aircraft is usually based with the ice breaker and is lowered on to the ice for take-off. However, the inadequacy of this system has long been recognized and the need for coastal air bases emphasized, although shore facilities still appear to be inadequate in spite of wartime airfield construction. Air ice-reconnaissance is now

carried out through the year with the exception of a break of three months in the winter darkness and one of a month in spring caused by difficulties of technique and organization. After 1945 a further variety of air reconnaissance was introduced: an aircraft now makes periodical runs along the whole sea route to gather an overall impression of ice conditions in the navigation season.

Like all other aspects of polar aviation, air ice-reconnaissance is hampered severely by harsh environmental conditions: bad visibility, low clouds, icing and the short days of the end of the navigation season. Climate also brings difficulties to fuelling and the construction of airfields.

Aviation is put to many other specialized uses. Air photographic surveys have been made of parts of the Lena river, the Glenyok river, the mouth of the Khatanga, the eastern section of the Taimyr Peninsula and elsewhere, although detailed maps had been made of only 8·3 per cent of the land area by 1940. Aeroflot has a special section known as the "Fish Air Force" now used in all large sealing, fishing and trapping expeditions. The wolves preying on reindeer herds are hunted in low flying PO-2 biplanes and whole packs are reported to have been destroyed by these methods in the tundra. Expeditions are serviced by the air transport of men and materials, while aircraft are used to carry spare parts to ships in distress and for rescue work. As in other remote parts of the U.S.S.R. Aeroflot is engaged on geological survey from the air.

Northern Canada rivals the U.S.S.R., its transpolar neighbour, in opportunities for aviation and environmental obstacles to development. Civil air flights began soon after the first world war. The pioneers were mainly service veterans who bought air force machines cheaply and found customers in the mining companies, prospectors and others working in the remote north. These men were the first of the bush flyers who flourish to-day. The Royal Canadian Air Force was also quick to operate in the north and in its early days had functions more appropriate to a government civil air branch than a military force, taking the lead in forest fire prevention, air photography and the establishment of supply depots.

The first organized civil air route followed the Mackenzie river from the Great Slave Lake to Aklavik on the Beaufort Sea: from 1927 it has taken urgent passenger and all mail traffic from the river steamboats. This line holds an important place in existing regular air services which also connect Yellowknife, Whitehorse and Churchill with southern Canada. There are irregular R.C.A.F. services to airfields in the eastern Arctic built between 1939 and 1945. In 1954 the North West Territories and Yukon together had 36 land and 27 water aerodromes, more than one-eighth of the Canadian total. There were also 19 auxiliary airfields in these areas.

There are many examples of spectacular air freight services in the north. The Eldorado uranium mine at Port Radium on the eastern

shore of Great Bear Lake, fewer than 30 miles south of the Arctic Circle, is supplied by air over the 1,200 miles from Edmonton; only particularly large and heavy equipment is transported by water during the one month in the year when navigation is open. The Eldorado Company's air freight costs are low because their Dakota and Curtiss Commando aircraft were bought cheaply as war disposal material, and the load factor is as high as 90 per cent. Transport to Port Radium is, nevertheless, cheaper by water but the short navigation season means that almost all traffic must go by air.

Air freight also played a notable part in the building of the 514-km.-long railway from Seven Islands in the Gulf of St. Lawrence to the Ungava iron ore deposits on the Quebec–Labrador borders. Exploitation of the deposits, estimated to amount to 415 million tons of high grade iron ore, was undertaken by the Iron Ore Company of Canada which began railway construction in 1950. At first the company intended to build a road to bring in construction materials but it was soon realized that the use of air transport would shorten work by a year and save $4 million. An associated air company was set up; airfields were built; and aircraft flew in men, food, fuel and all the necessary heavy material (bulldozers, mechanical shovels, tractors, cement, timber for bridge building and so forth). From October 1950 to December 1953 the company carried 138,700 passengers and more than 170 million lbs. of freight, a total exceeding 15 million ton miles. The air fleet consisted of ten twin-engined planes, five single-engined planes and two helicopters.

Canada makes more use of aircraft in forestry services than any country except the U.S.A. Aircraft watch for forest fires, take part in fire fighting and help with timber surveys. The Ontario Department of Lands and Forests has a special Division of Air Service with 48 Beaver and 30 Otter planes. Some aircraft are fitted with floats in summer for landing on the many lakes scattered through the forests, and with skis in winter.

The strategic significance of the northlands in the present political division of the world arises from the fact that the shortest flying distances between northern Europe, Asia and America run across the Arctic and north polar basins.

Perhaps the most striking expression of aviation in the northlands is Thule, the U.S. military airfield and town on the northwest coast of Greenland at 76° N., some 2,000 km. from Soviet bases on Franz Josef Land, 2,450 km. from Seattle and 4,300 km. from Moscow. Construction began secretly in 1951, when aircraft flew in materials over a distance of 4,000 km., and work is believed to have cost $500 million. Thule now has an airstrip three kilometres long, and amenities, including cinema, radio and television, for maintaining a community in the isolation and winter darkness of Melville Bay, where landings from the sea are practicable on only 70 days in the year.

Thule is a measure both of the rigours of the environment of the far north and of the extent to which lavishly applied engineering can make these conditions bearable. Among the major difficulties is the permanently frozen soil: the aluminium huts are built on piles to minimize escape of heat to the ground which would otherwise thaw and become unstable. Temperatures may drop to 47° below zero; a remote-controlled heating system is required; since windows cannot be opened, a central air-conditioning and lighting system is also necessary; and each house must have its own water tank and sewage disposal apparatus. Hurricanes are a menace; huts need a ballast of concrete and in the event of severe storms, orders are broadcast requiring each person to stay in the building in which he happens to find himself.

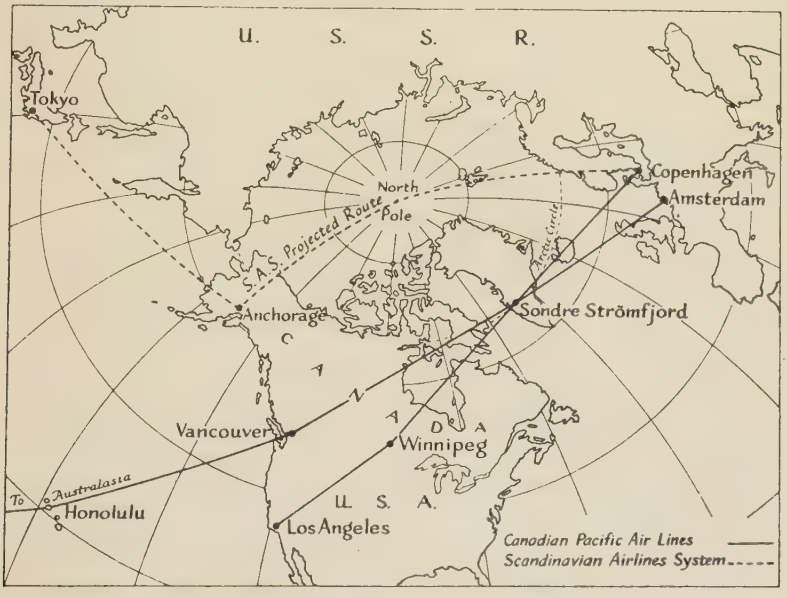

Fig. 2.—S.A.S. and Canadian Pacific polar air routes. (Reproduced by permission of the Royal Geographical Society.)

A second example of the military significance of the north is the three integrated warning and communication radar systems which straddle North America. Of these, the Pinetree system at 49° N. covers the industrial heartlands of Canada and the U.S.A., and the mid-Canada early warning line has been constructed at about 55° N. The most northerly, the Distant Early Warning (DEW) line, is being built by the U.S.A. on a route running from the flat tundra lands of the Arctic slope in Alaska and western Canada to the mountains of Baffin Island. Work on the DEW line began in 1955 and should be finished by the end of 1957. The cost is estimated at $400 million. In 1955 some 67 Canadian commercial aircraft and 34 U.S.A.F. planes were used on freight delivery to locations frequently set in

previously unknown country. Presumably there are comparable military developments in the U.S.S.R., where nuclear tests have been reported recently from Wrangel Island and Novaya Zemlya.

In contrast, civil airlines have been slow to extend trunk routes into the Arctic. Between 1945 and 1952 no long distance flight over the north polar basin was made by civil aircraft, but the Scandinavian Airlines System then flew a DC-6B with 24 passengers on its delivery flight from Los Angeles to Copenhagen, via Edmonton and Thule. The company began a regular Arctic service from Copenhagen to Los Angeles in November 1954, and has since carried thousands of passengers by this route.

Much of this traffic seems to have been taken from the traditional longer route through New York. Canadian Pacific Airlines are also flying a trans-Arctic line from Amsterdam through Sondre Stromfjord (in southwest Greenland) to Vancouver, Honolulu and Australasia. The success of these ventures is likely to lead other airlines to the Arctic.

A new phase in civil flying will begin in February when the Scandinavian Airlines System is to inaugurate a direct service from Copenhagen to Tokyo via the North Pole and Anchorage in Alaska. This flight will take $31\frac{1}{2}$ hours compared with 50 hours on the traditional route. Although aircraft will fly south of the great circle course to avoid Soviet territory the new route will save several thousand miles. I have no doubt that this pioneering effort will be followed by other north polar ventures in the next few years.

Thus, at the opening of 1957, aviation is penetrating to the North Pole on a regular commercial basis and to the South Pole as an adjunct to exploration. These are true geographical revolutions.

I have tried to set before you a few of the dramatic changes brought by world aviation in all its kaleidoscopic variety. My message for 1957 is a plea for the full utilization of air techniques in geography and for the study and teaching of the geographical consequences of the rapid growth of aviation.

REFERENCES

[1] R. L. S. Bruce Mitford (ed.), *Recent Archaeological Excavations in Britain*, London, 1956.
[2] *Land Utilization Map of Cyprus*, described on pp. 60–3 of this issue.
[3] *Report of the Commission on Inventory of World Land Use*, International Geographical Union, New York, 1956.

Geography and the Social Revolution

DAVID L. LINTON

HALF A CENTURY AGO H. G. Wells averred that the world had passed into an "age of transition", and in the years that have since gone by the rate of change has so quickened that it now deserves the epithet "unprecedented". In such a period of change happiness and peace of mind may be found only by the individual who can appreciate the nature of the change and adapt himself to it. This was probably the case for the statesmen-adventurers of the Elizabethan age of discovery, and for the successful industrialists and merchants of the Victorian consummation of the Industrial Revolution. But for those—either then or now—caught up and swept along by processes of change beyond their understanding or possibility of control, life means in great measure anxiety, frustration and misery. And this is as true of geographers as of any other thinking people. Geographers will surely not be happy in their work unless they can see some relation in its purpose to the current goals of human endeavour, and can relate its practice in some way to the needs of the times.

To do this clearly requires a two-fold analysis. First to grasp the real nature of the changes that beset us; and second, to consider what special relevance the study of geography may have in our newly evolving society. I am very conscious that I am in no sense fitted for either task. I have neither the vision needed for the former, nor the wisdom for the latter. But I have a conviction, that doubtless others share, that something needs to be said, and it is my hope that if I begin to say it others will see more clearly what needs to be said and say it better.

In my title I have used the portentous-sounding words "social revolution" and many may well feel that this is not necessary, that I am, in fact, in danger of spoiling my case by overstating it. Everyone knows that we live in difficult times, even critical times—times that are critical alike for personal well-being and for the national economy. But, they will ask, does this constitute "social revolution"? There seems only one sensible way to answer such a question—namely, to look back at what has unquestionably wrought a revolution in human society, the Industrial Revolution, and inquire whether characteristics similar to those of that great upheaval may be observed in the world to-day.

➤ Professor Linton read this paper on 4th January 1957 at the Annual Conference of the Association. In response to a request from the Conference for its early publication the Honorary Secretary has arranged for it to appear without delay in this issue of *Geography*.

Looking back at the Industrial Revolution three of its aspects appear to be particularly relevant to our present inquiry. First, special interest will always attach to the circumstances in which it began some two hundred years ago in this country. Next, we must note the way in which it spread from Britain across the face of the world, and last, we should consider the way in which the revolution itself was transformed as it proceeded and ask the question whether, in changed guise, it is not still with us.

The origins of the Industrial Revolution are, of course, not to be ascribed to a single factor or tied to a particular date. As we now see it, it arose rather from the favourable concatenation of four sets of circumstances, which however independent they were in origin reacted powerfully upon each other as time went on. These four sets of circumstances I should describe as a new population situation, a new husbandry, the availability of capital as never before, and a series of technological discoveries that permitted a thorough re-orientation of the natural resources of the country. The first three may be regarded as pre-requisite conditions without which the revolution could not have occurred, but it was the last which gave it its special force and direction. The new population situation arose from improved medical conditions reflected in a reduction of infantile mortality, but was sustained by the fruits of the new husbandry which in its turn permitted further improvements in public health by providing fresh instead of raw meat during the long winter and reducing the ravages of scurvy and other deficiency diseases. The increased labour force supplied by the increasing population was augmented by the effects of widespread enclosure and the success of the new husbandry provided some landowners with funds to invest in manufacture. The bulk of the capital for industry, however, arose from the nation's prosperity based on the woollen manufacture and overseas trade and the financing of the new ventures was greatly facilitated by the experience in money matters that had by the late eighteenth century made London the financial centre of the world.

In its most characteristic aspects the Industrial Revolution was an affair of coal, iron and millwrights, and led to the rise of the great coal-mining, iron-smelting, engineering and textile-manufacturing industries. The steam-engine, whose application to the de-watering of mines made possible the deeper mining of coal, itself required the increased production of iron which had resulted from the successful substitution of coke for charcoal in the smelting process. The possibilities thus opened up were soon applied throughout the field of engineering. Concurrently, the famous inventions of the textile industry led to its transfer from cottage to factory, the latter at first sited remotely beside some steeply falling Pennine stream, but later tied firmly by Watt's steam-engine to the coalfields. These changes brought others in their train, particularly those that constituted the

Transport Revolution of the nineteenth century, the construction, first of canals and then of railways, the application of steam power to ocean transport, and the substitution of iron and steel for wooden hulls in ships. By making possible the easy assembly of the raw materials of industry and the food of the workers, this led to the concentration of people in towns. With the heightened development of the factory system came its social consequences—the growing divorce between country and town and between rich and poor, and that exploitation of the working classes and the concentration of wealth and power in the hands of the capitalists against which Karl Marx protested so vehemently in the Communist Manifesto of 1848. In the course of roughly a century, from 1750 to 1850, the Industrial Revolution in Britain had revealed itself in all its chief aspects, and the economy of the country had been transformed.

Geographically, the marks of the Industrial Revolution are the mine and factory, railway and steamship, port and town. They spread from Britain during the nineteenth century across the face of the western world. They first appeared on the continent in Belgium, where the English mechanic William Cockerill had established an engineering shop at Liège in 1807, and the first coke blast-furnace on the continent was blown in in 1823 at the works established by his son at Seraing. The first railways appeared in Belgium, Germany and France in the 1830's and in Italy, Spain, Russia and the Scandinavian countries in the decade following. In the middle of the century the industrialization of the Ruhr began and reached spectacular proportions by its end. But further east the Industrial Revolution came in the twentieth century rather than the nineteenth. In 1908 Chisholm in his *Handbook of Geography* could still say that "factories are rapidly superseding hand labour" in the textile industries of Russian Poland, and he records the operation of the first coke blast-furnaces in southern Russia. Across the Atlantic the replacement of charcoal by anthracite in the abundant iron furnaces of the eastern United States had begun about 1840, but the great instrument of industrialization in North America was the railroad. Construction began as early as 1828 on the Baltimore and Ohio R.R. and a vast network rapidly spread across the continent reaching Chicago by 1853, and the Pacific by 1869. Industry followed in its wake and by the time the Welshman Hughes was starting his ironworks at what is now Stalino* in the Ukrainian S.S.R., and the United States Steel Corporation had established its works at Gary on Lake Michigan (1906), the Industrial Revolution had reached the effective confines of the western world. Beyond those confines industrialization is very recent in time and markedly discontinuous in location. Japanese activity it is true began with the century, but the real expansion of heavy industry in Japan dates only from the 1930's, just as the Soviet industrial complexes of the southern Urals and

* But originally called Yuzovka after its founder.

Central Asia are the product of successive Five-Year Plans beginning with that of 1928. The first large-scale industrial developments of India, Australia, South Africa and Brazil are matters of the present generation.

In this spread of industrialization Great Britain had a long start. For nearly a century the unquestioned workshop of the world, Britain was able to amass great capital wealth represented by its industrial plant and transportation at home, sources of food and raw materials overseas, an unrivalled merchant marine and an unchallenged navy to protect it. It came to wield power over an imperial domain of unprecedented extent, wealth and population. I was myself born in the closing years of the *Pax Britannica* and instinctively absorbed its pattern of thought; as children at school we had no need to be taught our innate superiority to our only thinkable rivals—the Yanks, Frogs and Germans. But inevitably the spread across the world of the ideas and methods of the industrial society led to the emergence of rivals to British economic supremacy. German rivalry became aggressive to the point of an unsuccessful war in 1914–18: Japanese commercial dominance of the Far East was converted into effective military domination of the vast "East Asia Co-Prosperity Sphere" by 1941. More significant than either, however, was the massive rise in the industrial and commercial status of the United States between the wars as indicated by the growing tonnage of U.S. shipping, both mercantile and naval, the growing volume of overseas investment and the power of the dollar in the money market. Side by side with the rise of the U.S.A. went the emergence of the Soviet Union as a major industrial power, under the impulse of the first two Five-Year Plans.

It is evident that in the countries to which industrialization came latest it came in its most up-to-date form. Lewis Mumford and other disciples of Patrick Geddes have long distinguished the Paleotechnic and Neotechnic phases of our industrial civilization, contrasting the mine, the railroad and "the insensate industrial town" of the former with the newer forms of power and communication. Mumford rightly insisted that the thermal electric power station and transmission network have released industry from its coalfield location, and that the motor lorry and the road network have released it from the railroad. The development of hydro-electric power, he saw, could lead to the growth of "well-balanced industrial communities" in remote mountain regions changing them from "the recreation grounds of the bourgeoisie" to "the favoured seats of living of an enfranchised working class". He regarded the application of scientific knowledge to agriculture as an essential part of the Neotechnic complex: the latter he believed would give equal service to town and country, to industry and agriculture, while the telephone and radio would promote communication at a distance and "at the same time diminish the need for physical movement and close settlement".

To some extent this is true. Tractors and combine harvesters have effected a mechanical revolution in the agricultures of many lands. The work of the biologist in such fields as plant breeding, vernalization and pest control, or of the chemist in the production of the organic chemical *krilium* with its valuable effects upon soil properties, may have profound consequences for agricultural productivity. But their social effects are as much to empty as to re-populate the countryside. The aeroplane has certainly been used for the development of remote places—as by flying in mining equipment to the Yukon, the mountains of New Guinea, or the Ecuadorian selva: but it is significant that after a year's fruitless exploration the whole of the last installation was flown out again. Our new means of transportation—our air-routes, our oil pipe-lines and our motor roads—in fact largely duplicate our railroads and our shipping lanes and converge upon the same major centres of manufacture and commerce. What has happened would appear to be an extension of the scope of the Industrial Revolution to farms and remote places that were previously little touched by it, and to increase the power and speed of industrial activity. And the outstanding geographical consequence of all this has not been the merging of town and country that Mumford hoped for. Rather would it appear to be the multiplication and growth of metropolitan or megalopolitan cities at the expense of their surroundings. In 1949 Preston James listed 51 cities each possessing more than a million inhabitants. To-day the total should probably be increased to sixty. Asia and Europe each have about a score, North America about a dozen, South America four, Australia two and Africa one (Cairo) though Johannesburg bids fair to join this class soon. These cities are the distinguishing mark of our time. For the smoking chimneys rearing through the foggy air above the overcrowded and squalid housing of the Victorian industrial town we have substituted the daily migration of vast numbers of people from their suburban homes to the congested centres of our great cities in overcrowded trains, trams or buses, and a traffic of commercial and private vehicles so great as to clog our city streets and to make road accidents a major menace in more countries than our own.

Our discussion so far has drawn for us a picture of a revolutionary process which in its Paleotechnic phase began in this country, spread across the western world, and established Britain as the world's paramount industrial, commercial and colonial power. Its Neotechnic phase has witnessed an industrialization of an entirely different style which, though it has not been absent from Britain, has developed with equal or greater intensity in many other parts of the world, especially in the U.S.A. and the U.S.S.R. No continent has been exempt from this development and, as a consequence, none is without the "millionaire-cities" that are its most spectacular expression. But no continent is so well endowed with natural riches as North America

and the Neotechnic phase has given world economic leadership and power unquestionably to the U.S.A., followed by the U.S.S.R. The momentum of the revolutionary process in its Neotechnic phase is not yet spent and may be moving toward a still newer phase based upon nuclear power. The nature of that phase, however, cannot yet be discerned and nuclear power at present is but an incident in the continuing Industrial Revolution. The power station at Calder Hall feeds into a grid established a quarter of a century ago.

It is not therefore a picture of a world in the throes of a new technological revolution leading to an atomic age that I wish to draw. Although technological change is going on around us with unexampled rapidity it is, as I see it, only an intensification of the old rather than a revolutionary new. The revolution that I believe to be in progress is neither mechanical nor scientific and is indeed as unlike the Industrial Revolution as I have tried to sketch it as could well be. It is a Social Revolution in the true sense of these words. For it is concerned with the diffusion of knowledge and ideas and the minds of men. The knowledge and the ideas are not new: they have been current for half a century or more. But to-day they may for the first time permeate all mankind and are seen in a new context. Thus, in the mid-twentieth century a new situation exists, a new concatenation of circumstances that may well provoke, as did those of the eighteenth century, a chain reaction whose ultimate course is as unforeseeable as that which began two hundred years ago.

To me there appear to be three aspects of this new situation:

(*a*) the global character of the space relations of society;

(*b*) the new world population situation created by the application of medical knowledge;

(*c*) the new situation in the spread of information.

The new space relations of society are manifest in at least three different ways. First, we may note the passing of the "world frontier". The expansion of population in the last century has been largely sustained by the taking up of new lands, to some extent in the southern continents but chiefly in Anglo-America and Soviet Asia, and by the discovery and exploitation of new material resources in all parts of the world. To-day there are no new lands, and though many resources of timber, coal, oil, minerals and power may still be found, there are now no new places in which to look. Using the word "frontier" as it was used by the U.S. Bureau of the Census until 1890, the "world frontier" has ceased to exist. The limits of man's domain have been reached. Second, we may take note of the point made by Preston James in 1949, that the basis of the industrial society is world wide. No national unit, not even the U.S.A. or U.S.S.R., is fully provided with all it needs, and some industrial communities, especially Britain,

Germany and Japan, are very dependent indeed upon imported raw-materials and foodstuffs. It appears to me that the "millionaire-cities" we have already alluded to are an expression of our industrial society in its external and internal exchange relationships: they depend upon traffic between their own regions and the rest of the world and as such can be very vulnerable to anything that affects that traffic adversely. The third way in which the changed space relationships of society are manifest is surely evident in the fact that no nation to-day finds it possible to pursue an independent foreign policy, whether the latter be active or passive. Isolationism was ended in the United States when the range of bombers became trans-oceanic. Active independent policies disturb world equilibrium and are apt to have results not foreseen by those who initiate them. British action in Suez has disturbed the Commonwealth, and Russian action in Hungary has disturbed the satellites, to a degree that can hardly be welcome to either government, to say nothing of repercussions further afield.

Our second transformation of the world situation arises from the advances of medical knowledge. These advances are now adequate for the control of the killing diseases of infancy and adolescence. In fact they have been brought under control already in most northwest European countries and a revolution in public health has been wrought here in our own lifetimes. In these European countries, and in Australia, New Zealand and the U.S.A., infant mortality to-day is only about a third what it was in the 1920's and the expectation of life (of males at birth) has been raised from about 48–50 years at the beginning of the century to 68–70 years to-day. In countries like Italy, Argentina and Japan, though the infant mortality rate has been just as strongly reduced, the original figure was 50 to 100 per cent higher, and the expectation of life has been raised in this century only from about 44 years to about 60. In Spain the improvement has been only from 34 to 47 years, and Spain may be said to be a generation behind her neighbours of northwest Europe in this matter. Still further behind are tropical territories like Jamaica and British Guiana, and South American republics like Chile where infantile mortality, though halved since the twenties, remains three to six times as high as in Sweden or Britain. In India, and presumably in China and some other parts of the world, the expectation of life remains very low: in India it has improved only from 22·6 to 32·5 years in the half century. Nevertheless, the trend is clear. It is only a question of time before the medical knowledge which has already been successfully applied in the western world is applied elsewhere. Professor Leslie Banks, addressing this Association a year ago, said "it may take 30, 50 or possibly 100 years, but I do not think it will be much more". The consequences, in terms of world population and its age structure, are to say the least of it very considerable.

Finally, the world situation has been transformed by radio and the cinema, which now disseminate ideas and information to all peoples everywhere. The impact of these inventions on the world of ideas is hardly less important than Gutenberg's in the fifteenth century. For there is now no need to acquire the skill of reading to be informed or misinformed. The café radio will tell you all Big Brother thinks you need to know. The standards of dress, plumbing, living and morals of Hollywood are imitated or criticized from China to Peru. Wittingly, or unwittingly, the occidental world has exported its ideas if not its ideals, and exposed its wealth and its weaknesses to illiterate and backward communities. The fact that in 1954 when television stations in this country could be counted on your fingers there were 29 such stations operating in Latin America, 16 in Japan, 2 in Morocco and 1 in the Philippines, gives a hint of a possible massive extension of this process.

This indiscriminate dissemination of ideas is of course a process that undermines democracy: it provides ready-made opinions while only a literate populace can become an informed electorate. It is a process that is inherently destructive rather than constructive. By making backward peoples aware of unfavourable contrasts in living conditions it promotes discontent. It is hence subversive of even the most benevolent of colonial régimes, as for example that of the Dutch in Indonesia, and has favoured the spread of Communism in southeast Asia generally. But for the same reason it might be successfully used to undermine Communism in the satellite states. The most contagious of all the ideas that has been thus spread from the western world is, however, not Communism but nationalism. The Marxian call to the workers of the world to unite died, perhaps, with Lenin. But militantly with us are the "upsurge of Asia" at the expense of the French, Dutch and British colonial empires, the nationalism of the Arab world, and Soviet imperialism and the opposition it is at last manifestly evoking. We dislike national patriotism in Egypt or Japan but applaud it in Hungary. In truth these changes are but an acceleration of those that began with the nineteenth-century collapse of the Spanish Empire in Latin America and the Turkish Empire in Europe, Africa and Asia.

It would thus appear that in respect of the space relations of society, of medical geography, and of the dissemination of ideas and information, the world is becoming, in Wendell Wilkie's phrase, "One World". As in 1750, there are here the elements of a chain reaction: the spread of ideas must lead to an increasingly insistent demand for improved medical conditions and so create population pressures that will strain to the uttermost the available material resources. But it is a reaction in society itself. Doubtless technology will make large, possibly immense, contributions to the problems that will arise. The more intensive use of land, minerals and power resources may be expected, and the use of nuclear energy may make possible much that is now

infeasible. But fundamentally the problems of the world in the coming decades are problems of social organization. The logic of "One World" demands an organization on the world scale, but it may well be that for a generation or more to come the impact of the new forces in many, perhaps most, parts of the world will be seen as a local problem demanding locally or nationally favourable solutions.

It would be idle for a geographer to speculate on the solution of problems, as yet hardly formulated, and lying in the fields of economics, sociology and politics. But the problems, it can already be seen, have a geographical basis in the unequal distribution of men, resources and opportunities over the globe. These facts are part of the geographer's stock in trade, and the geographers of to-day and to-morrow have a threefold duty to enlarge this body of factual knowledge, to codify and rationalize it, and to make it abundantly known. With your permission I will devote the remainder of my address to this matter.

There is a clear call here for more geographical research. It matters not what your specialism is—pursue it. Work is, or recently has been, going on in my own department on morphological mapping, urban and rural land use, local climate and atmospheric pollution, the evolution of slopes, population growth in nineteenth-century Sheffield, potential evapo-transpiration, the historical geography of settlement, the relations of soil development to denudation chronology, the growth of coal-mining in the local region, and the recognition in mountain and lowland regions of glacial and pre-glacial landforms. Any or all of these, it seems to me, may be vital for the further progress of the subject. Topics that to-day seem academic may lead to the development of new understanding or new techniques that can have practical application to-morrow. The only qualification I would make is this. Follow your specialism where it leads you but remember always two things: first, if it leads you into the territory of other workers, be they economists, pedologists or what you will, realize that you will be listened to and heard only if you take the trouble to learn and speak their language: and second, remember always that you are a geographer whose business it is to see things not as phenomena in isolation, but as they occur together in their regional settings.

Nevertheless, though it is my hope that geographical research should advance vigorously along the broadest possible front, we cannot but be influenced in our choice of investigations by the fact that the problems before us will be essentially world problems and at present we are hampered in our world view by our ignorance about much of its surface. Many of the problems will concern what I may call "resources geography" involving an appraisal of the resources of land, soils, water, minerals, power, and people in a region in the light of its space relations with the rest of the world. Such appraisals imply the application overseas of techniques of observation, mapping, analysis

and description perfected at home. British geographers have been backward in this matter, but they have an evident duty toward the colonial territories. There is a need for many more geographically trained research workers ready and anxious to work abroad, but there is a still greater need for funds to make such work possible. The scholarships given by the Goldsmiths' Company for research in Africa are a valuable step in this direction, but much more is needed if any headway is to be made.

As new knowledge becomes available it must be built into a new synthesis—a new dynamic picture of a changing world—and the nature of that picture must be made widely known. The writer of the textbook, the lecturer to University or Training College students, the classroom teacher, and the geographical journalist have all an essential part to play here. Mankind must be made much more aware of the world it lives in, its rigorous limitations and its limited possibilities. Above all it must be assisted and persuaded to think of the world as a whole.

Here as I see it is one of the two great challenges to teachers of geography in schools. Of how many secondary schools can it be said that every boy or girl leaves with a clear picture of the world as it is to-day? Yet surely nothing less must be the aim if the subject is to serve mankind as it should. In many schools the syllabus certainly covers the world—but what a difference there is between a 2, 3 or 5 year syllabus and a world picture! It will be urged that curricula are dictated by external examinations; if this be so it is clear that curricula can never be forward-looking or experimental. Twenty years ago teachers begged to be released from the bondage of the Leaving Certificate Examination and by the 1944 Act their shackles were struck off. Not relishing their freedom and responsibility they have worked diligently to manufacture new ones by using the General Certificate Examination as it was not intended to be used. They have made of it a sieve through which whole schools are strained—strained, indeed, in more senses than one. But for geography this will not do, and teachers of geography will surely be faced with a crisis of conscience before long—whether to teach the bits and pieces of information about wheat and iron ore in North America, or wool in Australia, or paddy fields in India, that will satisfy the O-level examiners, or to strive to wake in their pupils an awareness of the geographical character of the world they are about to enter as citizens. And as a first step to meeting this challenge let each of us take time and trouble to think hard about this world picture that should be set before the young. Until we have it in perspective ourselves we can pass on nothing useful or convincing.

The second challenge that I see confronting geography teachers in Britain is to teach the geography of our own country in this changed perspective. Since the end of the *Pax Britannica* in 1914 the economic

status of this country has declined both absolutely—in our production of coal and cotton textiles, in our overseas investments and our seaborne carrying trade—and relatively, by the industrialization of newer lands. The end of the latter process is not yet. Already the American and Soviet Republics have emerged as the two colossi of the industrial society, each with a resource base and an industrial structure broadly comparable to that of the whole of western Europe. The further progress of the Neotechnic Revolution is likely in the next decade or so to create a world with virtually full exploitation of available resources of land, minerals and energy, and in which the pattern of economic and possibly political power will reflect, not the course of history, but the geographical distribution of material resources. In such a world what will be the rôle and status of Britain? Gone are the days when Cohen-Portheim could envisage the voluntary adherence of the smaller maritime nations of western Europe to the British Commonwealth. More probable now seems the prospect of Britain entering a United States of Western Europe. In a world of fully developed resources the resource base of this island is too narrow for stability, possibly even for survival at our present standards of living. The more intensive application of science to agriculture may diminish our dependence on imported foodstuffs, and the large-scale use of nuclear power may give scope for new industrial activities. But our most valuable resource is surely the skill, intelligence, and productivity of our labour force, and there is an evident danger that in seeking ever higher standards of living our wage and salary earners may make this resource so expensive as to price the product from it out of the market. Since our skilled labour is our most valuable resource we cannot have too much of it: we ought obviously therefore to welcome automation and, as soon as possible, to end National Service.

We must look to our economists and economic geographers for an assessment of the changing relative values of our material and immaterial resources, but the fundamental fact has long been clear enough. A small island, not well endowed with natural resources other than coal, if it is to import raw materials for its industries and the larger part of the food of its fifty million inhabitants, can do so only if its people are more industrious than their neighbours. I will not elaborate a truth so well known but I do insist that it is our business to teach it. To-day the populace appears distressingly unaware of it* and I fear our teaching is to blame. I have the impression that alike in Universities, Training Colleges and Schools the geography of Britain is taught as the geography of its regions. Interesting and

* It will be clear that I see no likelihood in the genuinely foreseeable future that large parts of England may return, as Sir George Thompson suggests, to parkland where great herds of cattle, nourished on synthetic foods delivered automatically at distributing centres, will roam untended through the trees and provide targets, and a spice of adventure, for chemical engineers hunting them with bows and arrows. (*The Foreseeable Future*, 1955, pp. 115–16.)

important as regional differences are they should not allow us to forget the need to see Britain as a whole and in its world setting. It is possibly our prime obligation to our students and pupils as future citizens to ensure that they go into the world well informed in this respect. And though I will not repeat the plea made four years ago by our then President, the late Dr. Howarth, for more effective teaching of the geography of the Commonwealth, I would urge strongly in the present context that this is an essential part both of the geography of Britain and of the world picture that I believe it the prime duty of British geographers to expose and expound to their pupils and fellow citizens.

The prime obligation, I say, but not the only one. In the industrial society of which we are a part, in which life becomes continually more urbanized, mechanized and specialized, geographers have a special opportunity and responsibility. However we define our subject we are concerned with the works of man considered against the background of the forces of nature and, in practice, as they are found in a particular landscape. Alone among the sciences we are concerned with nature in the large—with the changing face of the sky, the rhythm of the seasons, with soil and rocks, with waves and running brooks. Alone among the humanities we are concerned with the concrete aspects of the world man has made for himself—his fields, farms, villages and towns, as they have been developed in the landscape and inherited from history. Ours is a unique opportunity—to kindle in the minds of the young an awareness of the unity of nature and of the unity of man with nature. We can create interests that may grow and become abiding in the hills, the skies, the rivers and woods, or the life of the fields, farms and villages. And of the sense of sympathy with nature and with our own past that such interests bring, the individuals of the urban and industrial society of tomorrow may well stand in sore need.

> Though absent long,
> These forms of beauty have not been to me,
> As is a landscape to a blind man's eye;
> But oft, in lonely rooms, and mid the din
> Of towns and cities, I have owed to them,
> In hours of weariness, sensations sweet,
> Felt in the blood, and felt along the heart,
> And passing even into my purer mind
> With tranquil restoration.

Some Enclosure Patterns in Central Wales

A Study in Landscape Modification

J. GARETH THOMAS

THIS PAPER ATTEMPTS TO APPLY THE METHODS of historical geography to a study of the effects of the Parliamentary Enclosure movement upon the landscape of a small area in upland Central Wales. The area lends itself particularly to this type of investigation, for apart from the actual enclosure of its wastes,[1] it was affected also in the last century by the development of lead mining which reached its peak in the eighteen-seventies.[2] Nor has the present century been without its modifying influences, for although the region has been one of almost continuous depopulation,[3] yet economic activity has by no means been at a standstill, as is witnessed by the creation and expansion within the area of the Forestry Commission's *Hafren* Forest. Despite these varying methods of exploitation however, some of which have now ceased to operate, it is perhaps the effects of the Enclosure Award which are of greatest interest to the geographer, for by being both widespread and lasting, they can still be seen in the present landscape, thereby affording an admirable basis for the interrelation of documentary evidence and field work.

The area chosen for study lies in west Montgomeryshire, and is typical of the country which flanks Plynlymon to the east. It extends to the north and northwest of Llanidloes, between that town and the sources of the Severn and Clywedog rivers. Territorially this area comprises four townships in the manor of Arwystli Uwchcoed, now in the civil parish of Llanidloes Without, while geographically it is plateau country with rolling topography falling in elevation from 1,500 or 1,600 feet above sea level in the west to about 750 feet in the east. The broadening valleys of the Severn, Clywedog and Cerist introduce lowland into the physical landscape, but this element is of significance only in the east, where restricted amounts of valley land are found at about 500 feet. The 1,000 feet contour significantly and conveniently divides the area into two sub-regions, the western being bleak rolling upland, whereon rise the streams which go to feed the Severn and its tributaries, while the eastern is more broken country, with steeper slopes due to river dissection, but for the same reason, with more shelter and more valley land. Geologically the area has rocks of both

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Ordovician and Silurian age, though differences between them are not reflected in the physical landscape and lead ore extraction has been determined by the occurrence of metalliferous lodes in both strata. The area is thus typical of upland Central Wales, with moderately good agricultural land in the valley bottoms and on the lower slopes, but with poor, ill-drained, peaty and thin soils on the more exposed plateau surfaces.

The Parliamentary Act which so considerably affected this region was the Enclosure Act for Arwystli (or Arustly) in 1816.[4] The lord of the manor was Sir Watcyn Williams Wynn, and it would appear that the idea of enclosing had been in his mind for some time, for between 1811 and 1813 he caused a return of every illegal encroachment upon the waste to be made by the constable of each township in the manor, together with the number of years since it was made.[5] The actual maps of the Award, however, were not drawn until 1826, and it is not until this date, therefore, that we can obtain any clear picture of the pre-enclosure landscape. From these maps, which were drawn on a township basis with a variety of scales and orientations, it is possible to transfer sufficient information to the modern map to reconstruct a cartographic representation of the landscape as it was immediately before the Award became operative. In the first place it is possible to delimit farmland which was already enclosed, and although the farm boundaries are not given, for such land was unaffected by the Award, yet every settlement is plotted and named on the maps, together with the name of the landowner. The extent of the waste can thus be demarcated, together with any enclosures and settlements which had been made thereon, for these are all marked on the maps, even though they may subsequently have been treated as illegal by the Award. Finally of course the maps illustrate the allotments and allocations which were made by the Act, so that they really give a picture of two landscapes, the one before the enclosure, and the one which was planned by it.

The first of these landscapes is shown on Fig. 1, where the information is complete except for a small region which was part of another manor, Talerddig, for which no Enclosure Award has as yet come to light. As is to be expected, the disposition of the waste in 1826 reflects the variations in the physical landscape. In general the limit of the waste appeared to lie between 900 feet and 1,000 feet above sea level, and accordingly, there was in the west of the area under discussion, a solid block of unenclosed land, while in the lower eastern part such land was broken in its distribution and smaller in its extent. The pattern of exploitation appears to have been typical of all such waste lands at this time, for it was regarded as inter-commoning land, shared by the farmers whose enclosed lands abutted on to it. No detailed accounts of the local organization of this practice have been found, but it was presumably little different from the accounts given, for example, in the

Report of the Select Committee on Commons Enclosure,[6] for similar regions in Radnorshire and elsewhere. Under these arrangements, farmers were allowed to depasture stock upon the waste provided that the numbers of such stock did not exceed the numbers for which they could provide winter feed on their own enclosed farms. It is of interest that in the Montgomeryshire parish of Carno, not far from our area, this arrangement is still operated and the farmers meet annually to decide what grazing facilities each shall have upon the still unenclosed land. These "intercommoning" farmers confess that the system is difficult to administer, and it has apparently always been so, for the report quoted above is full of instances of abuse, and of complaints that it was the law of the strong which operated upon the commons.[7]

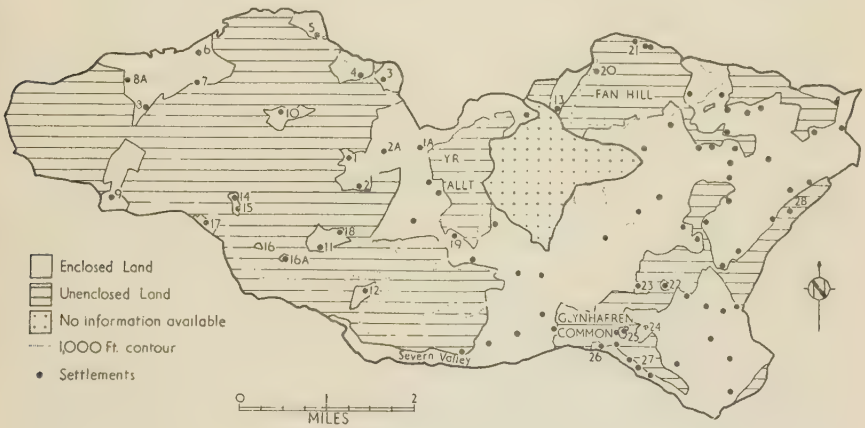

Fig. 1.—The pre-Enclosure map.

Such then was the economic system under which these lands were utilized. To refer to them as wastes may have been legally correct, but it was agriculturally a misnomer, for under a system of pastoral farming, such lands were essential to the more low-lying farms which by themselves were not economic units. The map of the area at this time would therefore be expected to have shown large expanses (actually some 5,224 acres[8]) as completely unenclosed. As may be seen from Fig. 1 however, this was not the case, for appreciable encroachments had been made upon the commons. The Award actually takes official cognizance of this fact, for it confirms the usual custom that encroachments of "twenty years and upwards" were to be regarded as legal,[9] this presumably being the reason why the pre-enclosure survey of all encroachments specifically asked the constables to state the age of the enclosures which they reported. That they rarely did so is perhaps not unrelated to the fact that in several instances they themselves were offenders in this respect. The Award maps, however, indicate all encroachments and "old enclosures" as they are called, irrespective of their status, and it is only by following up the manner in which these

lands were treated in the Allotments that it is possible to ascertain whether they were regarded as legal or not.

Additional information concerning illegal enclosures may, however, be obtained from a study of the Court Leet records of the manor of Arwystli from 1784 to 1819,[10] and from these it appears that the manorial authorities had been troubled by this practice for some time. Apart from temporary offences against the commons, such as peat cutting, for which the usual fine was one shilling, there were two types of more permanent offences involving actual enclosure, though these were usually effected by two different types of person. In the first place there was, of course, a strong temptation for landowners or tenants whose farmland was contiguous with the common to add to their property by the simple process of moving their boundary fences further out. This was usually done, not on an all-round basis, but rather at specific points, the size of the intake averaging from 2 to 4 acres, though more extensive encroachments of this type were not unknown. Secondly there was that type of enclosure which was effected by persons who were usually landless, and quite often without any means of subsistence at all. This was the well-known practice of "squatting," involving the legal fiction that if a house were to be built upon the waste in one night, so that smoke issued from the chimney by the morning, the builder had a right to the house and to such land as would be contained by throwing an axe in all directions from his new dwelling. This tradition of the *ty un nos* (one night house), or "morning surprise" or "clod hall" (from the materials of construction) has an interesting distribution in the Celtic lands,[11] but it was flouted by the manorial authorities of Arwystli, who invariably imposed a fine of £2 for "erecting a cottage upon the waste." The economic condition of such squatters was of course very unsatisfactory since their lands rarely exceeded 2 or 3 acres in extent, and they could not legally lay claim to the right to depasture on the waste. They were thus in continual conflict with farmers who had that right, and were often regarded as a very undesirable element in the parish. Some indication of this may be gained from an Arwystli Court case of 1809, where a person was fined for "purchasing and living" in such a cottage and in addition was ordered to remove himself to the neighbouring parish of Llandinam, whence presumably he had come in the first instance.

Such then was the background of activity upon and around the commons up to the time of the Enclosure, and the effects of such activities may be clearly seen on Fig. 1. This map illustrates three different types of encroachment. The first was that which resulted from the activities of farmers who made intakes from the common at various points where it adjoined their own farmlands, and two very clear examples appear at 1 and 2 on Fig. 1. In this case the farmland was divided between the two farms to the east of the common (1A and 2A), and the Award map plots two houses on this land in addition to

the homesteads proper, 1, Cae Crwn, belonging to the owner of farm 1A, and 2, Lluest Goch, belonging to the owner of farm 2A. It is highly probable that these two houses, situated as they were on the fringe of the common, were shepherds' cottages, and this is corroborated by the occurrence of the name *lluest*, which literally means cabin or hut. It has been suggested[12] that the name *lluest* was given in central Wales to what elsewhere was known as the *hafod*, or summer dwelling place of a transhuming pastoral society, though by 1826 the occupation was probably continuous. The link with the pastoral system is, however, clear, for these two cottages were sited so as to have ready access to that area of the common which would be used for depasturing by farms 1A and 2A. The position of the cottages inevitably leads to the suspicion that they themselves represent old encroachments, particularly since one of them is called *Cae Crwn* (literally round field), but there is no record that their legality was ever questioned. Indeed the evidence is to the contrary, for the Court Leet, by fining the occupiers of both in 1800 for peat cutting on the adjoining common, tacitly admits by implication that the cottages themselves were on legally enclosed land. The occupiers however were apparently not satisfied with the lands which they were renting, for again in 1800 they were both fined for enclosing land from the common, the tenant of Cae Crwn having enclosed 4 acres, and that of Lluest Goch 14.[13] It is by no means clear what happened to these intakes after the fines were imposed, but they appear to have continued in use by the offenders, for in both cases the Award maps plot old boundaries whose areas correspond to those quoted in the 1800 court case, and which were apparently accepted as legal. This is natural if the tenants had been left in possession after paying the fine, for by the time of the Award, their intakes would have been in existence for over twenty years. It is of interest to note in passing that while in 1800 it was the tenants who were fined for enclosing, in 1826 it was the landlords who benefited by having the intakes added to their properties. The form of these intakes may be clearly seen on Fig. 1 in the rectangular plot of land to the west of 2, and in the small plots projecting westwards from 1. Examples of the same pattern may be seen on the western side of Yr Allt common, on the southern side of Fan Hill, and on the common land to the east of it.

The second type of encroachment was in many ways similar to the first, and was quite clearly regarded by the Award as legal. The resulting intakes differ however in that they were not contiguous with farmland, but stand out on Fig. 1 as isolated enclosures whose distribution is confined to the common lands in the west. Having been made either by established landlords or their tenants, such lands were either successfully claimed for farms held elsewhere, or were themselves used as a basis for further claims, i.e., they were regarded as farms in their own right. Examples of this type on Fig. 1 are those numbered 3 to 12 in the west of the area, and possibly 13 on the western side of Fan Hill.

Many were in existence at the close of the eighteenth century, for there are Court records of their tenants being fined for peat cutting, and the tenant of 5 was fined in 1800 for enclosing, though there is no record or evidence to show exactly where. There is likewise no record to show how exactly these farms were created, for they may have been bought from the lord of the manor, or have been old enclosures which would have become legal by the time of the Award. Whatever their origins however, most of these land units, e.g., 1 to 11 and 13, were treated by their owners as farms, and were successfully used as a basis for claiming sheepwalks from the Award. With the exceptions of 7, 8 and 9 however, their size suggests that irrespective of how they were regarded, these units could have been little more than small enclosures with a cottage, erected as a convenient outpost by farmers who claimed rights of depasturing. 9 does not quite fit this category for here the unit was larger, and could well have been a farm in its own right, and this applies also to 7 and 8, where there were two houses but one owner. 8A is again in a different category, for this land, owned and enclosed by University College, Oxford, must presumably have been acquired in a legal fashion. It was actually an extension from a considerable block of land which the College held in the adjoining township to the north. 12 on Fig. 1, while similar to the remainder in shape and size, was somewhat differently treated by the Award, for it was not regarded as a farm, but was claimed, together with the surrounding land, for the valley farm of Glynhafren, though that farm had no valley homestead. It is therefore highly probable that the other units were not really farms, but that the title was a polite fiction which confirmed their legality, and allowed their owners, who may not have been their founders, to use them as a basis for further claims. The same principle seems to have applied to 14, 15, 16, and 16A, though these are much smaller, and may therefore have been more recent in origin. 14 was in joint ownership, while 15 was claimed by one of the largest landowners in the township. Both 16 and 16A were owned by a clergyman, who as well apparently as being an inveterate peat cutter was also the owner of several farms in the more low-lying land to the east. It is perhaps not without significance that this last group all have the element *lluest* in their names, and all were used successfully to claim blocks of land from the Award.

The last type of enclosure was that of the small-scale squatter, whose fate according to the Award was determined by his length of tenure. Numerous examples may be found in this area, and they are shown on Fig. 1 by 17 to 28, of which 21 and 27 refer to three, and 25 and 26 to two houses each. It is unfortunately only rarely possible to date the actual origins of these enclosures and houses, for although the Court Leet proceedings are full of fines against this offence, the general practice was to give only the name of the offender, and perhaps the general location of his cottage, and this is true also of the Constables'

reports. Thus, for example, while we know that in 1799 four people were fined £2 each for "erecting a cottage each on Glynhafren Common,"[14] we cannot tell which they are within the obvious group of squatters' settlements shown on that common in 1826 (25, 26). There are some cases however where it is possible to link the map evidence with pre-enclosure documentary records. Thus in 1812 the constable of Glynhafren reported that a certain Richard Owen had enclosed 2 acres and built a cottage called Rhydyronen.[15] This cottage and enclosure are shown on the Award map (17 on Fig. 1), and are ignored by the Award, presumably since they had not been in existence for twenty years. The cottage and enclosure of Brynmawr (18 on Fig. 1) can similarly be traced, for in 1802 the Court Leet fined a person for erecting a cottage on Brinmawr (sic), and in 1804 fined him again for enclosing two acres "adjoining Gwestyn," thereby incidentally allowing accurate identification to be made. In 1812 the constable of Glynhafren reported the existence of this cottage "and four acres," and the Award in 1826 plots and records it as a legal tenement. This story can be repeated almost exactly for Aberdeunant (No. 19), and while there is no concrete proof that this was also the case for 22 to 27, the coincidence of tenants' names in 1826 with those of people fined at various times by the Court Leet for squatting on Glynhafren Common, leaves little room for doubt. 26 and 27 are of especial interest, since some of the houses were connected with a "manufactory," obviously a water-powered woollen mill, and part of the growing woollen industry of the Severn at this time.

Such then was the landscape at the time of the Award, with its farmsteads, its legal encroachments, and its squatters. Fig. 2 is an attempt to illustrate the manner in which the Award modified this landscape by the enclosure and complete redistribution of its commons. In the first place the unenclosed land was divided into blocks called either sheepwalks or allotments. The former term was restricted to the higher land in the west, and referred to units larger than the allotments, but there appears to have been an arbitrary element in the distinction, for moorland on the Fan Hill, though typical sheepwalk country, and subdivided into very large blocks, was nevertheless referred to as allotments. One-twentieth of every sheepwalk, and one-fourteenth of the other allottable waste lands, i.e., those divided into allotments, was given automatically to the lord of the manor. Such lands are marked on Fig. 2, and it will be seen that in the east, where the allotments were small, the lord was given large compact plots, together equal to the requisite fourteenth, while in the west, his holdings thus acquired were dispersed, some of the sheepwalks being so large that a twentieth part of each formed a sizeable unit, though still of course too small to be of any economic use in itself. The remaining lands were allotted to people who could prove a claim on them, but there is no detailed account in the Award either of the principles by which the claims were settled, or

of the assessment which was made in each case. The resulting pattern of ownership in the landscape was fourfold, and type examples have been numbered on Fig. 2.

In the first place some blocks of land were allotted as units to landowners whose farmlands either lay outside the township altogether, or were situated at a considerable distance from the commons. Such blocks appear therefore on Fig. 2 as newly enclosed isolated units, e.g., 1, 2 and 3. More frequently however the allotments were made to landowners whose farms were contiguous with the old commons, and this

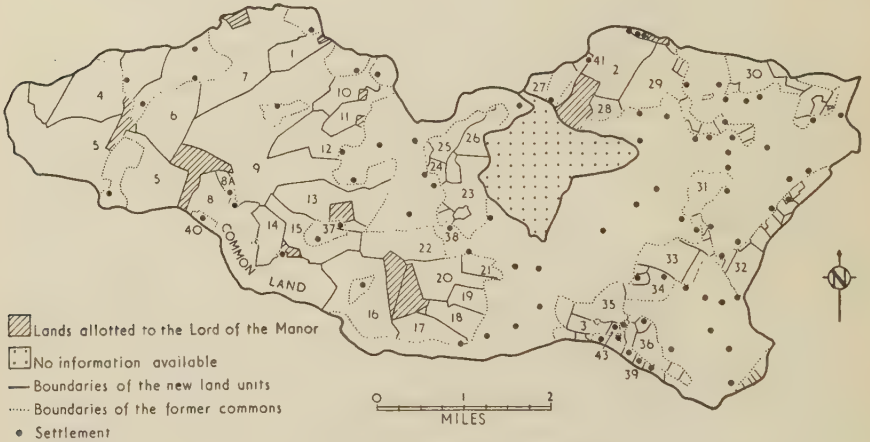

Fig. 2.—The landscape after Enclosure.

gave rise to the second and third patterns. If the farm was one of those which had probably been enclosed from the common in the first instance (e.g., 9, 10, 11 and 12 on Fig. 1), then the new boundaries represented a simple expansion from the old to form a compact unit, e.g., 5, 8, 14, 15, 16 on Fig. 2. If however the original farm had simply abutted on to the commons, usually at its upper end, then the new pattern showed a strip of newly enclosed land running from the farm into the old common, often paralleled by the similar strip of a neighbouring farm. Such are 10 to 13, and 17 to 22 on Fig. 2. This strip pattern was by no means ubiquitous and in the east of the area, where the extent of unenclosed land was less and its nature often more akin to farmland than to sheepwalks, the new units were more compact blocks, e.g., 28 to 36 on Fig. 2. To these should be added the smaller plots on Fig. 2 which to avoid cartographic confusion have not been numbered. 9 is anomalous, for the claimant owned land on both sides of the common which he claimed, so that his property ultimately took on a V-shape.

To these patterns should be added a fourth, namely that formed by the small-scale squatters. Where such encroachments were regarded as legal by the Award, they came to form small compact blocks, e.g.,

37 to 39 on Fig. 2, but in those cases where the claim to possession was rejected, the plots and their houses were simply included in one of the larger allotments, e.g., 40 to 43. In addition, the Award made one large allotment of Common Land (Fig. 2) and two small allotments to "the poor of Llanidloes," this land to be vested in the Llanidloes Churchwardens. This last may have been by arrangement with the tithe impropriator, but there is no evidence from the Tithe Commissioners' survey some twenty years later to show that the tithe claim had ever been extinguished in this area.

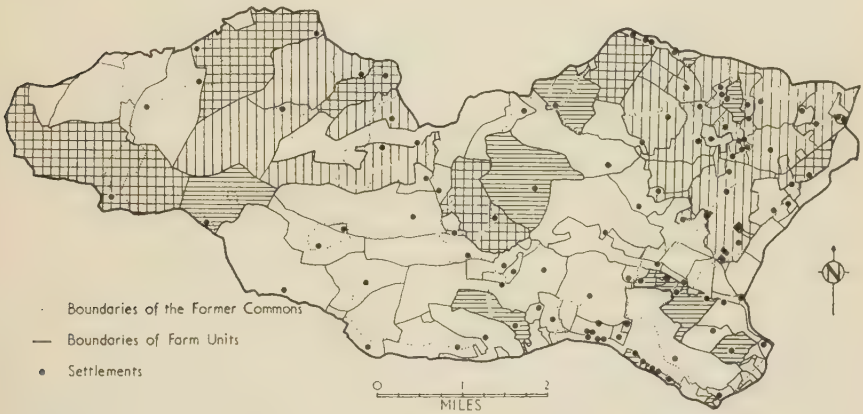

Fig. 3.—Tithe map evidence. The ownership of the three largest landowners is shown by separate shading.

Thus was the landscape modified by Act of Parliament, and subsequent changes have neither been so widespread in their application, nor so fundamental in their effect. The reservation should perhaps be made here that the Award maps of course represented the picture as it was hoped it would be, and there is no guarantee that every detail eventually worked out as planned. Indeed even within the Award itself, some slight modifications of the original plans appear, for it is recorded that the lord of the manor had already arranged to sell some of his small upland allotments to neighbouring landlords who had been awarded large blocks of land. In general however, the provisions of the Award seem to have been adequately executed, and this is shown by the tithe map evidence, of which Fig. 3 is a reconstruction.

Twenty years had elapsed between the Award and the date of the tithe survey, so that the evidence of tithe map and apportionment will show how the Award was working out in practice, and also whether any marked changes had occurred since it was made. Useful information is also provided concerning the lands which were unaffected by the Award, for it will be recalled that although the Award maps showed settlement on such lands, the boundaries of farms were not plotted in detail. Fig. 3 is based primarily on the occupancy of land in 1846, but

shows also the ownership pattern of the three largest landowners in the townships. These same three figure prominently in the Enclosure Award, with the difference that one of them, John Edwards Esq. in 1826, had become Sir John Edwards by 1846. Fig. 3 shows quite clearly that there was a very obvious difference in the pattern of occupancy between those lands which were enclosed at the time of the Award, and those lands which had been enclosed by it. The latter form very large units, with long straight boundaries, broken by sharp angles, while the former are much smaller, their boundaries conforming with no set pattern. This difference applies also to the lands which the Award enclosed in the east of the area, for here, although the boundaries are often geometrical, the actual units are small. The man-made landscape is thus simply conforming with the physical background, for as the west is bleak exposed upland while the east is less severe, so the west becomes the region of the large land unit with widely separated farmsteads, while the east becomes that of the smaller farm, with a more closely knit, though still dispersed settlement pattern.

Fig. 4.—Settlements on the Award (1826) and Tithe (1846) Maps.

A second feature which appears from Fig. 3 is that there had been a number of slight modifications to the Award between its date and that of the tithe survey. In the east these changes were confined mainly to changes of ownership which, while considerable, did not modify the landscape, but in the west more fundamental differences occur. Here, of course, the fact that the lord of the manor had sold some, though not all, of his smaller allotments, emphasized the compact nature of the landscape, while this trend was confirmed by the disappearance, presumably in the same manner, of certain other individual smaller allotments, e.g., 8A and 14 on Fig. 2. These were usually absorbed by neighbouring holdings, though 14 and the block of common land on Fig. 2 appear on Fig. 3 as a completely new farm unit privately owned but not by the person who was given 14 in 1826. On the other hand

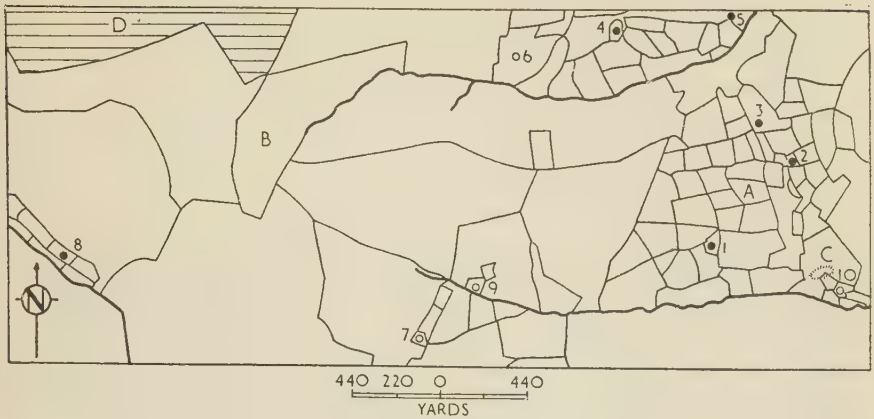

Fig. 5.—The landscape today. (Crown Copyright reserved.)

one of the largest units allotted by the Award (9 on Fig. 2) had by 1846 been subdivided into three farm units (Fig. 3) based on already existing settlements, while in the east, the building by 1846 of new houses on lands which were already enclosed in 1826 confirms this tendency towards fragmentation. Most of these new houses had small plots of land, and most of the occupiers were tenants.

This point raises the whole question of settlement and leads on to a consideration of Fig. 4, on which the settlements recorded by the tithe survey are plotted in relation to those shown on the Award maps. If Fig. 4 be compared with Fig. 1, it will be seen that those settlements which disappeared between 1826 and 1846 were either those of illegal squatters (1 and 2 on Fig. 4), or those which we have already suggested to have been shepherds' cottages, and therefore no longer so necessary when the sheepwalk was enclosed (3 and 4 on Fig. 4), or again those which were on small allotments which had been absorbed (5 and 6 on Fig. 4). 7 is of some interest since it had been on a legal enclosure, while as we have already seen, 8 was a squatting settlement which the Award had ignored. By the time of the tithe survey, however, the legal settlement had been abandoned and the farmstead moved to the site of the old squatter's cottage. The move was accompanied by a change in name, for while the Award refers to the unit as Lluestcwmbrynmawr, and successfully avoids mentioning the squatter's cottage at all, simply including it in the new unit, by the time of the tithe map it is the cottage name, Rhydyronen, which is applied to the whole farm. There is no record of what happened to the squatter, for in 1846, the tenant was a different person. Most of the new settlements in 1846 were in the east,

some of them, such as those along the Severn and Clywedog, being associated with the woollen industry, while others are the reflection of the slight tendency to fragmentation noted above. The plots associated with them are however so small that there must have been some other source of income, and here again it is probable that work in the expanding woollen mills provided it.

Fig. 5 is an attempt to show how the pattern of the Enclosure Award may still be discerned in the landscape to-day. In the limited strip chosen for illustration, A on the map represents the formless field pattern associated with pre-enclosure farms (including two squatter settlements) while B shows the pattern resulting from the Award. C and D represent respectively lead-mine waste and Forestry Commission lands. Thus the landscape, though continually changing, bears upon it the impress of the past, and one of the most significant contributions was that deriving from the activities of the Enclosure Commissioners.

REFERENCES

[1] 56 George III, c. 37.
[2] O. T. Jones, *The Mining District of North Cardiganshire & West Montgomeryshire*, Geological Survey Memoirs, Special Report, H.M.S.O., 1922.
[3] J. G. Thomas, "Population Trends in Wales," *The Welsh Anvil*, vol. iv, 1952, pp. 87–97.
[4] A general account of the Act is given in E. Hamer, "A Parochial Account of Llanidloes," *Montgomeryshire Collections*, vol. iv, 1871, pp. 415–16. The maps of the Award were formerly in the possession of the Montgomeryshire County Council, but are now in the National Library of Wales.
[5] Wynnstay Collection, MS. no. L 278.
[6] H.M.S.O., London, 1844.
[7] *Ibid.*, especially para. 1189–1323, and 3051.
[8] E. Hamer, *op. cit.*, p. 416.
[9] Quoted in preamble to Award Maps.
[10] E. A. Lewis, "The Court Leet Proceedings of Arwystli," *Montgomeryshire Collections*, vol. xlvii, 1941–2, pp. 183–207; vol. xlviii, 1943–4, pp. 11–29.
[11] R. U. Sayce, "The One Night House and its Distribution," *Folk Lore*, June 1942, pp. 161–3.
[12] Personal communication from Dr. Elwyn Davies.
[13] E. A. Lewis, *op. cit.*
[14] *Ibid.*
[15] Wynnstay MS., *op. cit.*
[16] O. T. Jones, *op. cit.*
[17] E. Hamer, *op. cit.* and continued in *Montgomeryshire Collections*, vol. v, 1872, pp. 1–72.
[18] J. G. Thomas, *op. cit.*

Vegetable Oils and Oilseeds

Aspects of Production and Use

ALAN B. MOUNTJOY

VEGETABLE OILS have been used for many centuries, but have assumed great economic importance only during the last fifty years. They are used in a variety of ways, being for instance ingredients in soap, paints and varnishes, lubricants and cosmetics. By far the largest demand for these fatty oils now comes from the food industries, but it would have been impossible to meet these demands but for the increasing use of edible vegetable oils as substitutes for and supplements to the traditional butter and lard. Supplies of these "traditional" animal fats are relatively inelastic; both cattle and pigs, produced in quantity within an intensive agricultural economy, have more specialized requirements than the wide and varied range of vegetable oil plants.

A fundamental difference between the two commodities is that most animal fat is the product of two-stage agriculture, while vegetable fat is a direct product. An animal is an inefficient means of converting grass, roots and cereals into human food: 85 per cent of the calorific value of the grass and crops fed into the animal is lost, having provided energy for the living beast or being unavailable as food in the inedible parts of the carcass or as excrement (indirectly of value as manure).[1] Vegetable oils, however, are prepared directly from the plants or tree-fruit; there is a minimum waste and a greater yield. An acre of groundnuts produces 260 lb. of vegetable fat, one of soya beans 150 lb. of vegetable fat (see Fig. 2), whereas the average cow yields only 46 lb. of butterfat per acre.[2] There seems little doubt that pressure of growing world population will enforce the adoption of the most efficient forms of land utilization, and despite the established position of animals in well-integrated mixed farming economies such a movement is likely to be made at their expense. The greatly increased demands for edible fats have been met only by the growth in the production and trade in vegetable fats, from which, following the discovery of hydrogenation, it has been possible during the last half century to supply solid fats much cheaper than butter and lard. To-day, three-fifths of world production of oil and fat is from vegetable sources.

The distinction between a fat and an oil is really one of character, fat being regarded as a solid, oil as a liquid, but these states are merely relative—given, for example, appropriate temperature changes solid fat will become an oil and oil can become a solid. Chemists have

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found that they can simulate the effect of temperature changes by varying the proportion of hydrogen in the substance. Thus they can raise or lower melting points and, in particular, create solid fats from liquid oils. This hardening process (or hydrogenation), now widely applied in industrial fields, was discovered at the end of the nineteenth century. Advances in chemistry during the last fifty years have made possible a high degree of interchangeability amongst edible and industrial oils and fats obtained from plants, animals and fish, although each oil product has its own special characteristics and none is equally suited for all purposes.

The principal sources of oils and fats are indicated in Table I. Their derivation from a wide range of climates is now a factor of prime significance, for the high degree of substitution of one oil for another has created a world-wide market for oil and fat purchases. The bulk of vegetable oils (90 per cent) entering international trade comes from only seven vegetable sources: groundnuts, cottonseed, soya beans, palm, palm kernels, linseed, and coconuts. Rapeseed, sunflower and olives are also widely cultivated, but most of their oils are consumed domestically, and small quantities of oil are obtained from many other species of trees and plants. The astonishing number and variety of products derived mainly or wholly from vegetable oils and fats, and the abundant possibilities of substitution, are shown in Table II.

The major use of the fatty oils is for food, and for this purpose far more vegetable oil is used locally than ever enters into world trade. The widespread use of olive oil in Mediterranean diets is a familiar example of this. The principal uses to which vegetable oils have been put in the United Kingdom are shown in Fig. 1 which reflects the changing world situation in edible fats. Compared with 1938 twice as much vegetable oil was used in 1953, and 70 per cent of it went to the food industries. The margarine industry took double its pre-war proportion of oil, the industry having expanded notably since 1939 as supplies of animal fats, especially butter, have become reduced. The proportion used in the manufacture of cooking fat shows a modest increase over 1934–8, although by 1953 the total *amount* used in this way had exactly doubled. The soap industry shows reverse tendencies: both the proportions of vegetable oils and the total fats used in soap manufacture in 1953 were less than in 1934–8, reflecting the reduction of soap and soap-powder manufacture as the production of synthetic detergents (from chemical and petroleum industries) increases.

The uses of vegetable oils in the United States show very similar tendencies. Margarine production has increased nearly fourfold since 1938. Margarine takes an increasing place in the diet of the American family: per capita consumption increased from 2·9 lb. in 1938 to 8·0 lb. in 1955, while that of butter fell from 16·4 lb. to 8·9 lb. Thus, in 1954, 21 per cent of available United States vegetable oil supplies went to the margarine industry (cf. 7 per cent in 1938), while 33 per

CLIMATIC ZONE	COLD	COOL TEMPERATE	WARM TEMPERATE	TROPICAL	EQUATORIAL
FISH	· WHALES · COD, MENHADEN, &c.				
ANIMALS		EUROPEAN CATTLE · · · PIGS · · · · · · SHEEP · · ·		ZEBU CATTLE	
TREES			· OLIVE · TUNG	OIL PALM	· · COCONUT · ·
ANNUAL PLANTS		· · FLAX · · · · RAPESEED · · · SUNFLOWER · · · SOYA BEAN · ·	· GROUNDNUT · · CASTOR · COTTONSEED · SESAME ·		

Table I. The Principal Sources of Oils and Fats

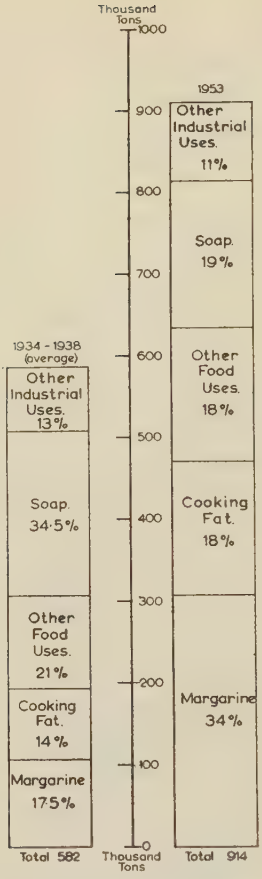

Fig. 1a.—Use of vegetable oils in Great Britain in 1934–8 (average) and 1953.

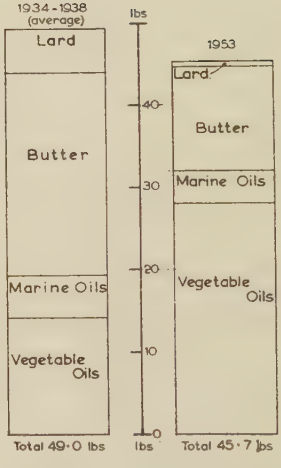

Fig. 1b.—Annual oil consumption in Great Britain, 1934–8 (average) and 1953.

cent was used in the manufacture of cooking fat, a slightly smaller proportion than in 1938 (34 per cent) although the *amount* of cooking fat produced was nearly one-third greater. The fall in the price of animal fats in the United States, especially Corn Belt lard, is a reason for this decline and has led to an increase in the proportion of animal fat actually blended with the vegetable oil in the manufacture. The United States soap industry took barely 4 per cent of vegetable oil supplies in 1954; again the proportion of animal fats used increased markedly, but total soap production was less than in 1938 (although the population had increased by 32 millions*).

The salient features of the world production and trade in the main vegetable oils are shown in Fig. 2. The *groundnut* requires tropical or

* United States production of synthetic detergents, which amounted only to 7,000 tons in 1938, reached a million tons in 1954. During this period the output of soap fell from 1,400,000 tons to 780,000 tons. The decline has been concentrated upon laundry and industrial soaps rather than upon toilet varieties.

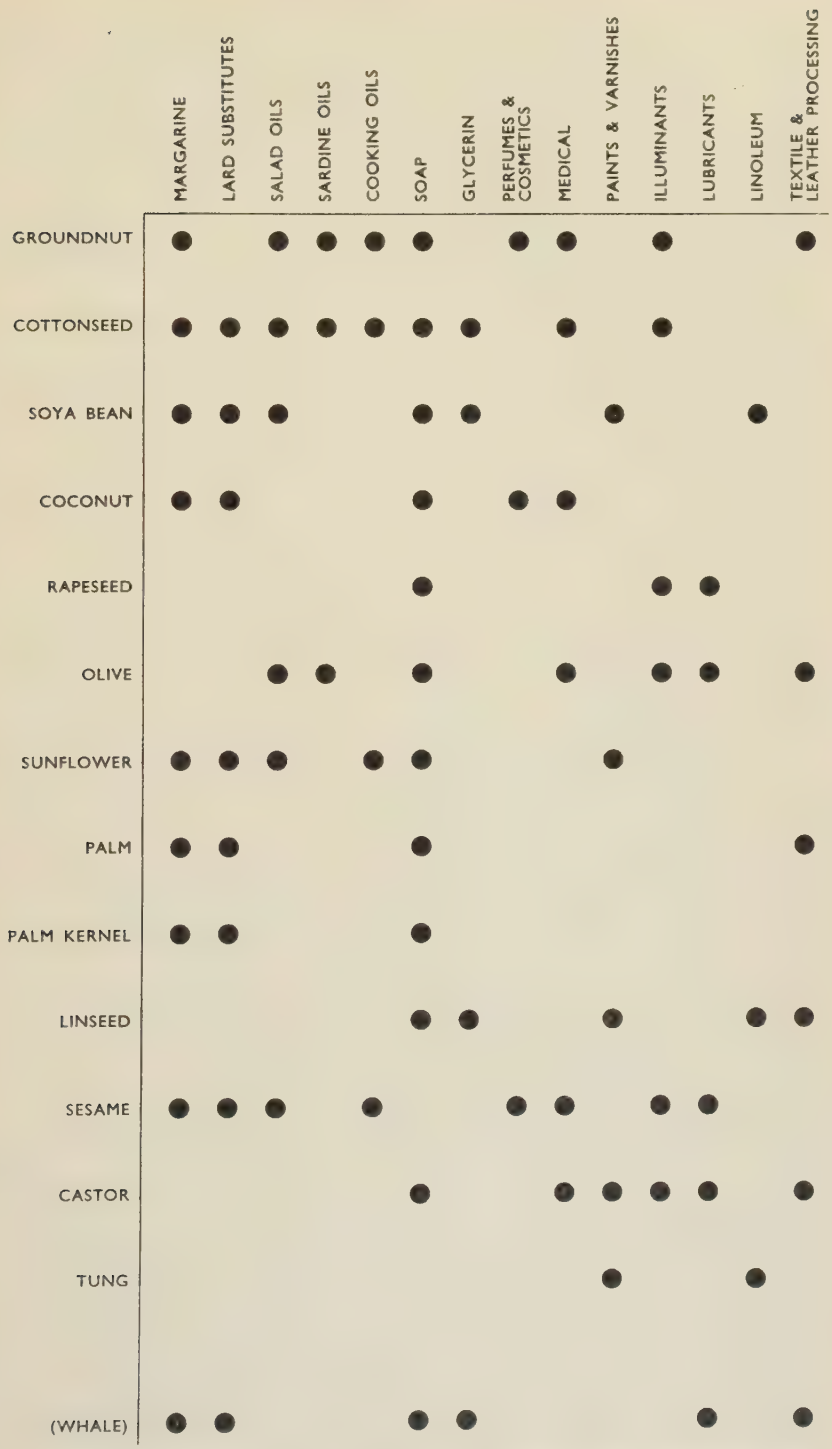

Table II. Principal Uses and Interchangeability of the Leading Vegetable Oils

sub-tropical conditions, a rainfall minimum of 20 inches, and does best on light sandy soils. It is the world's greatest single vegetable oil crop, but by far the greater part of the crop finds a domestic market (only 14 per cent exported in 1953). The yield of oil per acre from groundnuts far exceeds that of the other annual oil-yielding plants. The nuts are not only crushed for oil, but are also consumed directly as a staple of diet or as a sweetmeat. Already it has the second largest acreage of any plant grown primarily for its oil. India, China and the United States are the three leading producers, but the bulk of the nuts and groundnut oil for export comes from French West Africa and Nigeria. There is much scope within the savannah areas for acreage expansion (at present restricted by lack of bulk transport facilities) and, indeed, it is likely that it is to the savannah belt of Africa that Europe must look for its imports in the future, for it is unlikely that India, the former chief exporter, will return to the market: within her own boundaries exists a potential market capable of absorbing all that she may grow.

Cottonseed differs from most of the other oil crops in that it is a by-product: the plant is grown for cotton-fibre, not for the seed (one pound of lint is about 8 times as valuable as a pound of seed). The demand for cotton is responsible for the level of production of cotton-seed, for it would not pay to grow the cotton plant for its oil alone. The oil content of the seed is low and the yield of oil per acre is only about half that of the other principal oil-yielding plants. As a result, cottonseed cannot stand high transport charges between ginnery and crushing mill, and in many less-developed producing countries where both transport and crushing plant are inadequate little of the seed is crushed, but is used as fuel, manure or cattle feed. India is notable in this respect: most of its large production of seed is fed whole to cattle or thrown away, and up to 1953 no adequate arrangements existed for the collection of this useful by-product of the country's large cotton crop. Only about 5 per cent of world cottonseed and cottonseed oil production actually enters international trade; domestic markets claim a great deal (the U.S.A. exports only 3 per cent of her vast production), and throughout the world much is wasted.

In terms of world production the *soya bean* is the third most important oilseed crop. Originally confined to the Orient (where the high protein content of the bean is of particular dietetic value), cultivation has spread throughout the world—a process much accelerated by the last war. In particular, since 1938 the United States has more than quadrupled her annual production to become the world's greatest single producer and the uses of the soya bean in the United States have changed markedly. Originally it was an industrial raw material (particularly in paint and soap manufacture), but the great increase in production during the last two decades is due to the rising domestic consumption of margarine and cooking fat, of which soya bean oil has

become a major component (as we have seen, production of cottonseed oil, the other main ingredient, is relatively inelastic). This changing emphasis is reflected in changed land-use patterns.[3] Soya beans now have the fifth greatest acreage of United States crops (after maize, wheat, oats and cotton), and 90 per cent of its 14 million acres are to be found in the Corn Belt, where the crop also provides green fodder and rich cattle-cake.

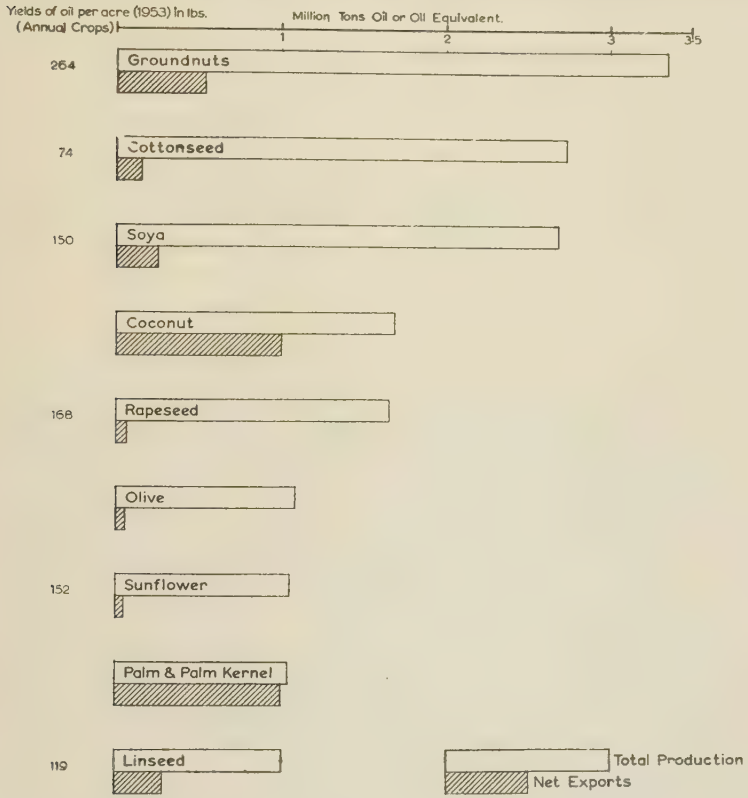

Fig. 2.—World production and net exports of oil crops or oil equivalent in 1953.

Among the remaining principal vegetable oil sources the *oil palm* and *coconut* are outstanding. Coastal and near-coastal areas of West Africa, from Gambia to Angola, and southeast Asia are the chief producing areas. Production figures can be little more than estimates, since much comes from wild trees and a great deal is consumed by the native peoples. In Malaya and Indonesia, plantation methods of palm oil and coconut oil production have been introduced with advantage over the wild and small-holding production of, for example, West Africa. Coconut oil is expressed from copra, the dried flesh of the nut; the oil palm tree provides two types of oil, that from the fruit (called palm oil) and that from the kernels (palm kernel oil).*

* See H. R. Jarrett, "The oil palm and its changing place in the economy of Sierra Leone," pp. 50–9 of this issue of *Geography*.

These three vegetable oils are significant because of their paramount position in the world's vegetable oil trade (they account for 59 per cent of all exports). Further, the trees grow in tropical and equatorial regions where other forms of productive land use are limited, while their efficiency as converters of the sun's energy into vegetable oil is unrivalled. Before 1939 the joint yield of palm and palm kernel oil on Sumatran plantations attained 2,880 lb. per acre. Such yields have not yet been achieved again (in 1953 Indonesian plantation yields per acre averaged 1,900 lb. of vegetable oil), but there is no reason to suppose that they may not even be surpassed in years to come. The coconut palm is also high-yielding in terms of oil per acre when grown under the plantation system: the yield from Malayan plantations in 1953 averaged 631 lb. These yields should be compared with those of the annual plants of more temperate latitudes (Fig. 2), most of which give no more than 150 lb. of oil per acre and are far more expensive to cultivate.

The world's greatest consuming area of vegetable oils, Western Europe, produces them only in very limited quantity. The United States, by vigorous changes in her agriculture since 1938, is now 90 per cent self-sufficient (cf. 60 per cent in 1938) and, in fact, exports certain vegetable oils and seeds in addition to her traditional exports of animal fats. By calculating the oil content of the principal oil-yielding crops it is possible to compare the production of various countries.* Table III shows China and Manchuria as the greatest producers, with the United States second. Production of the leading countries has increased since 1938 except in Indonesia and Argentina. Nigeria now appears as a new leading producer and in one important aspect her production differs markedly from most others: the majority of her oilseeds are grown for export—92 per cent of total production was exported in 1953, when Nigeria became the world's leading exporter of vegetable oils and seeds.

The production and export figures also indicate remarkable changes in the status of India as a vegetable oil producer and exporter. Before the war India was the world's first exporter (in terms of oil equivalent): by 1953 she was fourteenth exporter, sending out only 2·5 per cent of her total production. Her withdrawal from the world vegetable oil-seed trade has had wide repercussions upon production in other countries and the general availability of certain oils. India's critical food situation in the last decade has led to the retention for domestic

* There is a great difference between the oil content of the crops and the amount of oil actually produced from them. Much crop production is used for seed and large quantities are directly consumed as food. In the East soya beans are grown primarily as a food crop; sunflower seed is eaten as a table nut in some areas, and sesame is widely used in confectionery. The proportions of world crops used for oil extraction are (approximately): groundnuts 55–65 per cent; soya beans 65–70 per cent; cottonseed 75 per cent; sesame 85 per cent; rape and linseed 90 per cent.

Table III

PRINCIPAL PRODUCERS AND EXPORTERS OF VEGETABLE OILS AND OILSEEDS, 1938 AND 1953

Producers				*Exporters*			
(in thousand tons, oil equivalent)							
1938		1953		1938		1953	
China and Manchuria	3,460	China and Manchuria	3,790	India	651	Nigeria	552
India	1,950	U.S.A.	2,480	Indonesia	613	Philippines	433
U.S.A.	1,290	India	2,230	China and Manchuria	532	Indonesia	350
U.S.S.R.	1,112	U.S.S.R.	1,230	Argentina	419	U.S.A.	270
Indonesia	890	Indonesia	780	Philippines	375	French West Africa	242
Argentina	585	Nigeria	600	Nigeria	336	China and Manchuria	240
Philippines	430	Philippines	540	French West Africa	234	Belgian Congo	200

Production figures calculated from *Vegetable Oils and Oilseeds*, H.M.S.O., 1954.
Exports from Table III, *ibid.*

consumption of practically the whole of her oilseed crop. The production of *vanaspati* (a hydrogenated vegetable oil similar to our cooking fat, and made primarily from groundnut oil) has increased notably since the war and is now India's most important food-processing industry. Production in 1954 of 231,000 tons far surpassed Britain's production of cooking fat (169,000 tons).

Most vegetable oilseeds provide a useful and valuable meal or cattle cake after the oil has been extracted, and this is another factor to be taken into account when appraising the value and rôle of these commodities. While oilcake has a secondary value as a fertilizer, its principal use is as a concentrated feeding stuff for milch cows and fattening stock, valued not so much for its oil content, which is small, as for the high protein content, so necessary for milk production and flesh formation. Decorticated groundnuts, cottonseed and soya bean are particularly protein-rich (41–47 per cent), whereas others such as coconut cake and palm kernel cake have only a medium protein content (19–23 per cent). In most cases the weight of cake produced is greater than that of the oil, but as a residual product its value is smaller. Table IV shows the percentage yield of oil meal and the ratio of meal to oil for the principal oilseeds. The most important cattle cakes fed to stock are cottonseed, soya bean, groundnut and linseed: all are protein-rich and have a high meal/oil ratio.

Western Europe offers the largest market for these concentrated feeding stuffs, in particular the dairying and cattle industries of Sweden, Denmark,* the Low Countries and Britain. Before 1939 the bulk of

* For example, in 1954 Denmark's net import of feeding stuffs for her animal industries amounted to £20·7 millions.

Table IV

OIL AND MEAL CONTENT OF THE PRINCIPAL VEGETABLE OILSEEDS

Oilseed	*Oil content per cent*	*Residual Meal per cent*	*Meal : Oil Ratio*
Copra	63	35	0·56 : 1
Sesame seed	45	48	1·06 : 1
Palm kernels	45	53	1·18 : 1
Linseed (flaxseed)	33	65	1·98 : 1
Groundnuts	31	43	1·38 : 1
Sunflower seed	25	73	2·92 : 1
Cottonseed	18	45	2·5 : 1
Soya beans	15	80	5·33 : 1

Based upon Hansen and Mighell, *Oil Crops in American Farming*, U.S. Dept. of Agriculture, Technical Bulletin No. 940, 1947, p. 8, with modifications from *Vegetable Oils and Oilseeds*, H.M.S.O., 1954, p. v.

vegetable *oil* that entered world trade was exported from European countries, which had long-established crushing plant and ready outlets for both oil and cattle cake. The crushing of oilseeds has become a recognized industry at such major ports as Liverpool, Hull, Hamburg, Rotterdam and Antwerp. This pattern of trade, however, is in process of change. A marked development in recent years has been the establishment or expansion of oilseed crushing industries in the primary-producing countries, particularly India, French West Africa, Belgian Congo, Argentina. These developments are intended to provide greater supplies of oil and cake for domestic use and to create export industries. There are also the benefits of lower freight costs when oil rather than seed is exported. Thus, whereas in 1938 oil exports accounted for 26 per cent of the total amount of net exports of vegetable oils and seeds, by 1954 the proportion of oil exported had reached 48 per cent, and oil-export lists are no longer headed by Britain, France and the Netherlands, but by the primary-producing countries themselves. It is doubtful whether these changes will proceed much further: whereas oil from primary producers found a ready market in the early post-war years, the situation is now hardening and tariffs in importing countries tend to favour imports of seed rather than of oil in order to support their crushing plants.

The composition of trade in oilseeds is to some degree influenced by the demand for cattle cake (a demand which fluctuates with the condition and prices of fodder crops generally), for it is clear that the crushing residue of, for example, linseed and soya beans is more eagerly sought after than, say, coconut residue: this may well be reflected in the choice of vegetable oils used in the manufacture of margarine, cooking fat, soap, paints and varnishes. These considerations may, in certain cases, affect crop distributions. The wartime expansion of tung tree cultivation in the Western Hemisphere now seems to be halted. One reason may be the growing competition of synthetic drying agents, but principally it results from the competition of linseed and the low cost of Chinese tung-oil exports. Linseed cake

is a valuable feeding-stuff, whereas tung cake is of use only as a fertilizer, and linseed can largely be substituted for tung in paint and varnish manufacture.

In examining the patterns of production and trade in vegetable oils we find competition between the oil-producing plants themselves, and also competition with both animal and marine fats. We may also find competition between climatic zones: Zimmermann has written graphically of the fight between the vegetable oils of the tropics and the hog fat of the Corn Belt, "between the spontaneous products of nature, only loosely related to a price economy, and cultivated products raised on purchased or leased land, with borrowed money, and with the aid of purchased capital goods and of hired labour whose wages are determined by market conditions".[4] It is twenty-five years since those words were written, but still as much as one-third of exported vegetable oil comes from wild or semi-wild growth. However, it is clear that ideas of absolute competition are outmoded, and that rather we must regard the tropics as having come to the help of the animal industries of temperate latitudes to supply a demand that the animal industries could never have met.

In temperate latitudes vegetable oil plants must also vie with the many other competitors for the use of land; nor is this competition simple, since the prices obtained for the various oilseeds reflect the vigorous competition of the other vegetable, animal and marine oils from divers parts of the world (a much wider group of competitive commodities than, say, that of the food or feed grains), and by-product benefits must also be taken into account. Thus, flax (for linseed) is a popular rotation crop in certain dairy farming areas, but its hold depends upon prices obtained for food grains or for other feeding stuffs. For example, in the United States flax acreage in the Hay and Dairy Belt falls if the price for wheat rises substantially, or if there is a decline in the price of soya bean cake from the neighbouring Corn Belt.

The complexity of the economic geography of vegetable oils and fats stems from the high degree to which the various edible and industrial fats—vegetable, animal and marine—can be substituted for one another. Variations in harvests and prices in particular parts of the world have consequences embracing widely different oil-bearing materials in quite distinct parts of the globe, and naturally Government action, tariffs, currency restrictions, price support policies, may play a part in influencing competition and particular trade patterns. For example, Argentina increased her sunflower seed production fourfold during the last war when Mediterranean olive oil supplies were uncertain. By 1942 sunflower seed provided a substantial export surplus as well as the bulk of domestic edible oil supplies. Since 1951, however, acreage has fallen and exports have become negligible. Government manipulation of prices paid to primary producers led to a reduction of planted area, since prices obtained were unfavourable

relative to those for grains. The Argentine farmer prefers to grow cereals: if the crop fails they can generally be used for fodder, whereas sunflower seed could be a total loss. Price obtainable must be weighted accordingly. As a result, in the 1953–4 season the Argentine became a net importer of vegetable oil, and despite the raising of the support price for sunflower seeds from 480 to 600 pesos per metric ton (and leaving those for maize and wheat unchanged) the 1955 crop was 12 per cent smaller than the previous season. Acreage did increase slightly, but poor weather reduced yields.

Theoretically, regional variation of supplies due to bad seasons can be remedied: a poor West African groundnut crop might well lead to heavier buying of soya beans or cottonseed oil—provided currency problems do not intervene. A good Antarctic whaling season may reduce the price of palm oil, since whale oil and palm oil are both widely used in European cooking fat and margarine manufacture. To the West African native price variations might well prove both damaging and inexplicable, and in the British territories Marketing Boards operate, one of their functions being to reduce annual fluctuations in the prices paid to native producers. Yet in comparison with other commodities entering world trade these price fluctuations are not great. Ease of substitution makes competition both multifarious and global, and helps to keep vegetable oil and fat prices low and, further, to keep them steady.

Although animal protein is a very necessary part of a balanced diet, it is questionable how far it can be supplied mainly by meat in the future. Cheese is a highly concentrated combination of proteins and fat and cheaper to produce than meat: there are less wasted original calories with milch cows, which may yield in milk about a third of the energy of their vegetable food. If land has to be used more rationally in the future it seems likely that liquid milk and cheese will be the main products of the world's dairy herds, and that the high cost of butter will virtually remove it from the market. Its place will be taken by spreadable fats made largely from vegetable oils, the residual meal from seed-crushing providing an important part of the dairy herd's diet. Provided it is fortified with vitamins A and D vegetable oil margarine offers nutritional value identical with that of butter.

Human consumption of fat is closely linked with the standard of living. At least two-thirds of the world's population exist on diets below the minimal levels considered necessary for health, vigour and happiness.[5] Fats have high nutritional value and are the most concentrated energy foods, a gramme being valued at 9·3 calories (grammes of protein and carbo-hydrates are both rated at 4·1 calories); they are more rapidly digestible and more satisfying than other foods, which they make more palatable. While they are interchangeable with sugar and starch in diet, they usually cost more than these and the greatest per capita consumption is in countries able to afford

more varied diets. From figures computed by the United Nations Organization in 1949, countries with a per capita income of under $100 per annum consumed 7·9 lb. of fat per head per year, but countries with a per capita income of over $500 per annum had a fat consumption of 42·7 lb. per head.[6] The heavily populated primary-producing parts of the earth, particularly tropical Asia, have a very low fat intake although a host of vegetable oil trees and crops are indigenous in these parts of the world. The introduction and growth of *vanaspati* production in India seems to be the beginning of inevitable steps whereby Asia processes and consumes more of her own food. Sir Geoffrey Heyworth has estimated that the per capita consumption of edible oils and fats in Western Europe doubled between 1850 and 1950.[7] The population also doubled during this period, thus total demand quadrupled during the century.

In the past two decades the average annual increase of production of oilseeds has been 1·3 per cent, a rate of increase exceeded only by that of potato and maize production and substantially above that for wheat, rice, millet and sugar. This rate of increase is identical with the estimated annual rate of increase of world population between 1950 and 1980. Since 1946 world increase in edible fat production has exceeded population increase, permitting a slight rise in consumption of fat per person. Consumption of fat in the United States and Western Europe is still slightly below pre-war levels, but consumption in Asia (excluding China) has risen by about 30 per cent.

Adequacy of future supplies of vegetable oils for both edible and industrial purposes would seem reasonably assured. The utilization of large equatorial and tropical areas of great potentiality, which so far contribute little, seems inevitable, and the gradual organization of primary production into the most efficient units and systems will allow the application of scientific advances of the kind which have produced better strains of such crops as wheat, maize, cotton and rubber. The tropical and equatorial possessions in Africa of the great industrial powers, Britain, France and Belgium, offer the greatest opportunities for the expansion of export oil crops. It is clear that already Africa is replacing Asia as the main surplus vegetable oil area.

REFERENCES

[1] Imperial Bureau of Animal Nutrition, *Technical Communication* No. 14, London, 1953, table 29, p. 46.

[2] Statistics are quoted or calculated from the Commonwealth Economic Committee's Reports *Vegetable Oils and Oilseeds* and *Dairy Products*, H.M.S.O., London, and from *Commodity Reports: Fats and Oils*, U.N.F.A.O., Rome, all published annually.

[3] J. C. Weaver, "Changing patterns of cropland use in the Middle West," *Econ. Geogr.*, vol. 30, 1954, pp. 1–47; A. A. Munn, "Production and utilization of soy beans in the United States," *Econ. Geogr.*, vol. 26, 1950, pp. 223–34.

[4] E. W. Zimmermann, *World Resources and Industries*, New York, 1929, p. 299.

[5] P. E. P., *World Population and Resources*, London, 1955, p. 27.

[6] United Nations Food and Agricultural Organization, *Food Balance Sheets*, Rome, 1949, p. v.

[7] Sir Geoffrey Heyworth, *The Place of Margarine in the Economics of Nutrition*, Unilever Ltd., London, 1952, p. 5.

The Oil Palm and its Changing Place in the Economy of Sierra Leone

H. R. JARRETT

THE GREAT IMPORTANCE OF THE OIL PALM, *Elaeis guineensis*, in the economy of West Africa, has long been recognized. The tree is one of the Palmae family, of which the genera *Elaeis* and *Raphia* are restricted in distribution to America and Africa (including Madagascar); *E. madagascariensis* is a related species from Madagascar, and *E. melanococca* from Brazil. From a botanical standpoint *Elaeis* is not a tree at all, but a form of grass. It is most widespread in the wetter parts of the Guinea coast, and occurs in particular abundance in the southeast of Nigeria, where the "oil palm belt" stretches from Calabar as far westwards as Benin City and Warri. In this belt are found dense groves of the palm such as are not common elsewhere in West Africa.

In the Guinea savannah, oil palms do not occur on the grasslands, but they are restricted to swamps and forest outliers. The palm requires a minimum annual rainfall of 55 inches, but for the most part the Nigerian palm belt experiences 70 inches or more, while the boundary of the oil palm belt in Sierra Leone nowhere lies far from the 100-inch isohyet (Fig. 1). The tree will tolerate a rainfall of as much as 250 inches, though seed germination is greatly retarded where a high proportion of days is sunless and comparatively cool.

A moist yet fairly well-drained soil seems to produce better quality trees, but as long as moisture and temperature conditions are satisfied the question of soil fertility appears not to be an overriding one; we have seen that one of the major oil palm belts lies in the southeast of Nigeria where the excessively high rainfall has produced heavily leached soils.[1] Reasonably good yields can be obtained from poor soils, but initial bearing is retarded as can be illustrated by figures referring to trees on a Sierra Leone plantation. The four trees, planted in 1946, are located in increasingly poor soils, and the statistics refer to crop yields over the period 1951–5 (data kindly supplied by the Department of Agriculture, Sierra Leone).

There is reason to suppose that certain diseases which occur in the oil palm do so as a result of soil deficiencies, especially of potash,

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	Tree A		*Tree B*		*Tree C*		*Tree D*	
	Bunches	*lb.*	*Bunches*	*lb.*	*Bunches*	*lb.*	*Bunches*	*lb.*
1951	4	5½	0	0	10	14	0	0
1952	5	15¼	6	16¼	1	6¼	0	0
1953	4	27½	9	24¼	3	30	3	12½
1954	15	88½	16	68	2	30	2	5
1955	21	72¼	31	108½	16	80¼	5	17½
Average	9·8	41·8	12·4	43·4	6·4	32·0	2·0	7·0

while the widespread "orange frond disease" is quite possibly due to lack of the micronutrient magnesium.

One interesting feature is that although the oil palm is so common in West Africa, it is extremely uncertain whether it can be located in a truly wild state. It is not native to the areas where it is now most widespread, but it has been introduced by man; nowhere does it grow in the primary forest, but only where man has interfered by making clearings for his crops. It is generally agreed that the seedlings which occur in the "bush" originate from seeds dropped by hunters

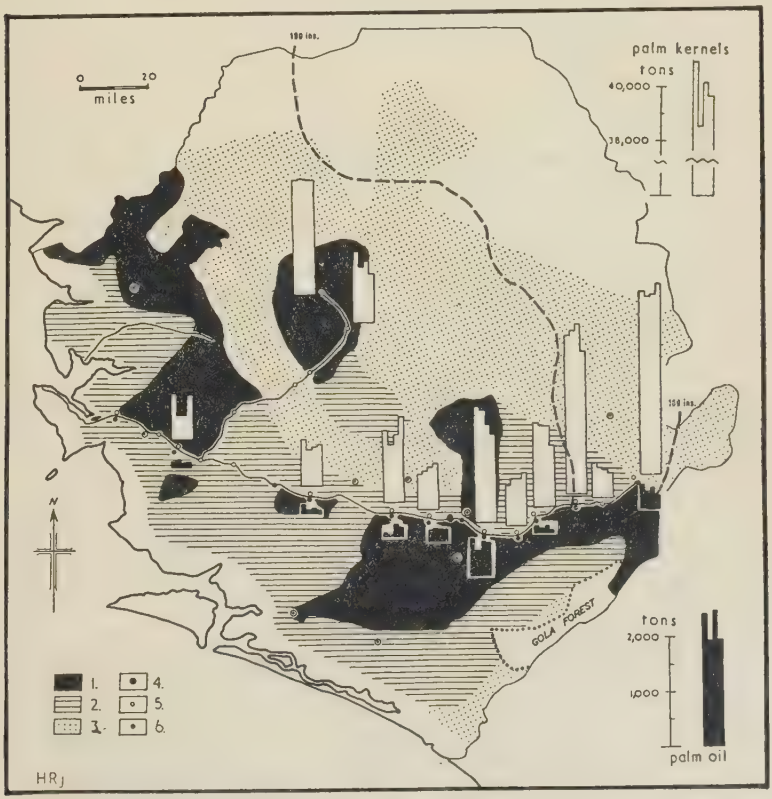

Fig. 1.—Some aspects of oil palm geography in Sierra Leone. 1.—major oil palm belts; 2.—oil palms, moderate density; 3.—oil palms, sparse; 4.—pioneer oil mills; 5.—railway stations palm kernels; 6.—stations railing palm oil. Amounts railed (scale as margin) from the more important centres for the four years 1949 to 1952 are shown, and, marginally, the total amounts railed during these same years.

or other travellers. There is much dispute as to the home of the oil palm, though most authorities, perhaps, favour the fresh water swamps such as occur widely in the Guinea lands;[2] some, however, look to the forest outliers of the savannah. Almost all are agreed that the palm could not have maintained itself beneath the closed canopy typical of virgin tropical forest. Even in moderately dense secondary bush the tree has to struggle for existence, and the erect and spindly trunk may then attain a height of 45 feet after fifteen years or so; under more favourable conditions such a height is not known. Ten-year-old palms on a plantation in Sierra Leone have trunks only five feet high, though the fronds, finer than those normally found adorning wild trees, reach upwards another eight feet.

The trunk is surmounted by a crown of fronds which are produced from a single apical bud commonly known as the "cabbage"; young trees have a characteristically ragged appearance as dead frond bases remain attached to the trunk, but after a period of about twelve years these normally drop off, and the trunk is then fairly smooth. The inflorescences spring from the angle between the leaf bases and the trunk, but although male and female occur on the same tree cross-pollination is customary as the two rarely open on any one tree at the same time. The flowering reaches a peak towards the end of the rains (October–November), with a subsidiary peak at the beginning (April–May). The maximum production of fruit occurs just before the rains set in, and the farmer will know that a bunch is ready for picking when he sees ripe fruit which has fallen to the ground. The usual method of climbing the taller trees is with the help of a strong loop made of piassava fibres which is passed round the trunk and under the armpits; the climber leans against this support and "walks" up the tree, jerking the loop higher and higher. This method is necessary when trees are very high, but ladders made from the centre ribs of oil palm fronds or from bamboo are used for climbing trees up to about 25 feet high. Normally only one bunch (which may well weigh up to 40 lb. if growing on a mature tree) will be ripe on a tree at any one time, and this will be detached simply by cutting through the stalk so that it falls to the ground. Much time and labour would be saved if the palms were shorter so that climbing would be unnecessary, and attempts are now being made to cross *Elaeis guineensis* with the dwarf *Elaeis melanococca*, to produce a shorter tree.

Young trees will come into bearing surprisingly early under plantation conditions—mostly always during their fourth year. Seedlings are usually given one year's growth in a nursery before being transplanted to their permanent positions, and experiments conducted in Sierra Leone have demonstrated the desirability of planting out early in the rains so that the young tree can establish itself before the dry season desiccates the soil. This is true even when fertilizers are carefully applied. Trees are planted symmetrically in 25 feet squares to

give ample clearance and weeds are kept down; the tree does not, therefore, have to struggle upwards for light and air. Under these conditions an acre of planted palms of even the poorest quality will maintain a yield of 6,000 lb. of bunches *per annum* over a very lengthy period, whereas yields from typical palm groves in eastern Nigeria are of the order of only 2,000 lb. The tree suffers when it has to compete with other palms in the closely packed groves, or indeed with any other vegetation, and under these conditions, in strong contrast to the plantation tree, a self-sown seedling will be exceptional if it starts to bear before it is 15 years old. Even so, plantations are unusual in British West Africa owing to the reluctance of Colonial Governments to disturb the *status quo* of the old social order, but until more plantations are established the competition from those of the Congo, French West Africa and Malaya will be a serious menace. It is probably true to say that British West Africa has hitherto maintained a large measure of social stability at the expense of economic progress, but signs of change are not wanting.

A further difficulty, which we can do no more than mention here, but which is a very real one, is bound up with land tenure. It is by no means unusual in West Africa to find that several different rights may be held over the same piece of land; for instance, one family may hold the right to plant crops, another to pasture animals, and yet another to pick fruits. Rights to oil palm fruit on any one plot may be vested in as many different families as there are trees. Such complications make it almost impossible to bring about permanent land and crop improvements.

Returning to the question of the crop itself it is perhaps worth emphasizing that the yielding powers of the oil palm are very high—indeed, it is said to be "easily the most efficient producer of vegetable oil judged by the yield of oil obtainable from an acre of land. This holds good even when the relatively low yields produced under West African conditions are taken as the basis."[3] The orange-coloured palm oil is produced from the mesocarp, and some typical fruits are illustrated in Fig. 2. There are several West African varieties of oil palm, each one with different yielding capabilities. For instance, those which produce fruit with a thin mesocarp (and thick shell) like *macrocarya* and *dura* will yield less than those with thick—in fact, yields vary from about 11 per cent of oil by weight to 23 per cent so it is well worth while encouraging the dissemination of thin-shelled varieties, especially since most of the Sierra Leone palms as well as those in many of the Nigerian creek areas are thick-shelled. This work is being greatly advanced by careful cross-pollination—sometimes in surprising ways. For instance, the *pisifera* variety has the unexpected characteristic that the fruits usually fail to ripen, but after a period of normal development the whole of a bunch of fruit goes rotten. Yet where *dura* is crossed with *pisifera* the progeny are 100 per cent *tenera*, thin-shelled

and with a good-sized mesocarp; when *dura* and *tenera* are crossed, however, the progeny are 50 per cent *dura* and 50 per cent *tenera*. The unpromising *pisifera*, therefore, is valuable in helping to produce a useful hybrid.

After the bunch of fruit is detached from the tree, it is important that the extraction of the palm oil should proceed with a minimum of delay, for immediately after cutting chemical changes within the mesocarp lead to the formation of free fatty acid (f.f.a.). In this respect, too, the plantation is at an advantage, for the fruit can quickly be treated and oil extracted with a f.f.a. content of as low as 1·5 per cent or less, while loose fruit from the natural palmeries, cut, hand-stripped, and then laboriously delivered to the mill, can rarely yield oil with less than 3·5 to 6 per cent. The Nigerian Oil Palm Marketing Board still finds it necessary to purchase oil with up to 30 per cent f.f.a., though this is the lowest grade now taken (grade IV), the newly introduced "special grade" (4·5 per cent or less f.f.a.) being available in increasing amounts. These facts emphasize the need for the further improvement of the palm oil producing industry in British West Africa, and the need for speedy treatment of the fruit underlines the importance of developing a good transport system in oil palm areas.

While traditional methods of extracting the palm oil vary greatly, we can group them into "hard oil" and "soft oil" methods according to the final product. The presence of appreciable amounts of f.f.a. renders the oil solid at normal air temperatures, even in the tropics, and this is hard oil; soft oil is, as its name suggests, liquid. Hard oil commands a lower price though it is easier to prepare, but the policy of the Nigerian and Sierra Leone Marketing Boards of paying substantially higher prices for better quality oil has considerably reduced the amounts of hard oil now being exported.

In the hard oil methods of extraction the fruit is left piled up in the bunches so that fermentation loosens the fruit which can then easily be detached. For the preparation of soft oil the fruit must be detached more quickly and boiled in water, which softens the mesocarp and arrests the formation of f.f.a. Some high quality oil is obtained in this process, skimmed off the surface of the water. After this preliminary treatment it is necessary to mash the fruit, and this is sometimes done by pounding it vigorously in tall wooden mortars for about 15 minutes and sometimes by treading with the feet. For the latter method special pits measuring 16 feet by 8 feet are constructed in some areas, lined with stone or clay, into which the boiled fruit and water is thrown. The mixture is then trodden down by the women, and more oil can be skimmed off. In other areas this treading is done at one end of a hollowed-out tree trunk which can then be tipped so that expressed oil flows to the other end for collection. The mashing treatment produces a mixture of oil-bearing fibres and nuts, and is followed by

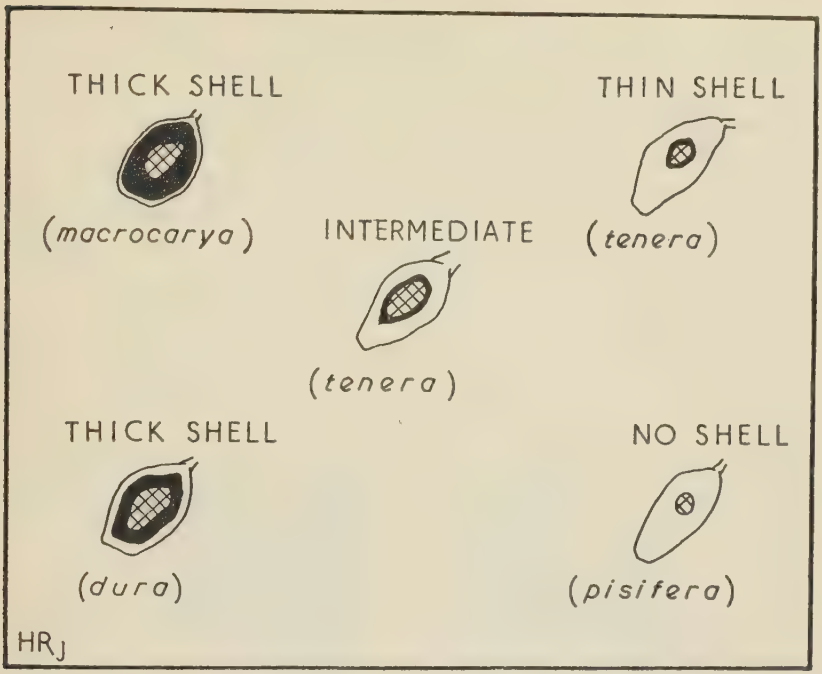

Fig. 2.—Five types of palm fruit seen in section (half actual size). The unshaded outer layer in each case is the mesocarp from which comes the palm oil; the solid black layer represents the hard woody shell which must be cracked to release the kernel (cross-hatching).

the expression of the greater part of the oil by one of various methods. One of the more interesting is to squeeze the fruit fibres (after the nuts have been picked out) by putting them into a long rope net which is then strongly twisted at each end. This, too, is women's work. The fibres may afterwards be boiled again in water to obtain a further skimming of oil.

In many areas small hand-presses, which will hold about $1\frac{1}{4}$ cwt. of fruit, are now in use, but even by this means a considerable quantity of oil remains unexpressed. It is estimated that the hand-press can extract at least 65 per cent of the oil content, as opposed to the 55 per cent obtained by the hand methods. 85 per cent can be extracted by the pioneer oil mill, however, and the f.f.a. content is probably appreciably lower.[4] Palm oil is widely consumed, and enriches the diet by the provision of vegetable fat and vitamin A; it is used in soup, and in the well-known "palm oil chop", in which a base of rice, meat and palm oil is highly spiced to provide a characteristic West African dish.

The palm nuts are by no means so widely used, partly because it is a matter of some difficulty to extract them from the hard shell; in earlier days, indeed, when the value of the kernels was not realized, the nuts were either thrown away or used as fuel in blacksmiths' furnaces. More recently the nuts have been cracked usually by women

and children, using a large stone as an anvil and a smaller one as a hammer—a very tedious process—and palm kernels now form a valuable export from West Africa. Palm kernel oil is extracted on a small scale domestically, chiefly for use as a pomade for the skin and as a hair oil, though it is also used as a cooking fat.

Apart from this dominant function of providing one of the food staples of the West African, *Elaeis guineensis* has a wide variety of other uses. The fruit fibres which remain after expressing the oil are often sun-dried and used as fire lighters; the oil itself is used in soap manufacture; the shells are useful for fuel; while the refuse from the bunch is a valuable source of potash. Palm wine, usually obtained by tapping the trunk just below the crown, is produced on a very wide scale, and certain tribes such as the Limba of Sierra Leone specialize in its production which may be regarded as equivalent to the brewing industries of many other countries. The leaves of the palm are widely used for thatching; the broad frond stems, or mid-ribs, for fencing, constructing ladders, or protecting the tops of mud walls; while the "cabbage" is sometimes cooked and eaten as a vegetable.

The domestic importance of the oil palm in West Africa is twofold, for while the tree yields products which are widely used in the Guinea coastlands, it has also happened that the world demand for palm oil and palm kernel oil, sustained over many years, has made it possible for Colonial Governments to impose export taxes on these commodities. Taxes collected on palm kernel exports from Sierra Leone during each of the years 1948–53 inclusive amounted to £99,647, £117,473, £178,185, £257,537, £767,565 and £742,556, though the amount on palm oil is very much less (£14,656 in 1952). These are substantial figures, the more so since the taxation accruing from customs duties is the largest single source of revenue; out of a total revenue of £5,058,000 in 1953, customs dues produced £2,375,000, of which taxes on palm products accounted for 31·3 per cent or 14·7 per cent of all revenue. It is clear that any falling off of these exports must be of the greatest concern to the Sierra Leone Government.

On a world scale oil palm products constitute about 8 per cent (by weight) of the total world trade in vegetable oils,[5] while they rank as seventh in importance among these oils. Southeast Asia and tropical Africa supply 98 per cent of the palm oil exports of the world, Asia 32 per cent and Africa 63 per cent, the largest single contributor being Nigeria (34·4 per cent) which also contributes no less than 53 per cent of the total world exports of palm kernels. Sierra Leone supplies 9·4 per cent of these,[6] a large figure for so small a country. The Nigerian situation has been dealt with elsewhere,[7] and the remainder of this article will be concerned with recent developments in Sierra Leone, where the paramount importance of the oil palm in the export economy has for long been recognized—and is still being commented upon.[8]

For the first three decades of this century palm kernels and palm oil dominated the export trade of Sierra Leone, often providing 90 per cent or more by value of the total of all exports. It is perhaps salutary at the present time to draw attention to the considerable change which is occurring in the export pattern of Sierra Leone, as the importance of oil palm products is markedly decreasing. Fig. 3 shows the extent of this recession which is most marked in the case of palm oil exports which were well down in 1952. There was a further drop in 1953 (362 tons) and a small recovery in 1954 (921

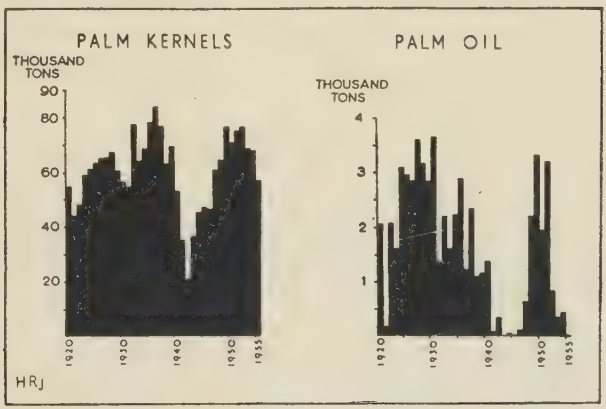

Fig. 3.—Exports of palm products from Sierra Leone, 1920–55.

tons), but only 21 tons were exported during 1955 while 300 tons were imported! The recession in palm kernels is less catastrophic, but it exists: 76,375 tons (1952), 68,904 (1953), 68,080 (1954) and 57,640 (1955). From 1948 until 1954 inclusive the proportional importance of oil palm products in the export trade of Sierra Leone was 43·8 per cent, 35·8 per cent, 47·5 per cent, 48·1 per cent, 36·5 per cent, while in the first half of 1955 it was 20·9 per cent. This represents a vastly different picture from that painted in the text-books and referred to above.

Now a *proportional* decrease in the importance of a single export is not necessarily a bad thing, if it reflects a broadening of the export trade of a country as it does in some measure in Sierra Leone. It might be worth emphasizing this point of view in the recent rapid increase in mineral exports. The first mineral to be exported was iron ore of which 24,550 tons were shipped from Sierra Leone in 1933,[9] but there are now significant exports of diamonds and chromite also. In 1954 the estimated value of the iron ore export was £2,707,324 (877,306 tons), of diamonds £1,699,875 and of chromite £165,025; there was also a small gold export (£26,573). These minerals represented 41·8 per cent by value of all exports for 1954 (1953 figure 50·1 per cent) and their importance to Sierra Leone can further be gauged from the fact that during the same year mining interests spent within

the country no less than £3,486,000, representing a sum of about £1 14s. 0d. per head of the total population, while roughly one person in every 100 now gains his livelihood from the mines. This is a very high rate of development over a period of only 20 years, and is indicative of the substantial mineral wealth of Sierra Leone.

When we have said this, however, we still have to face the fact that there has been an astonishing *actual* decrease in oil palm exports, portrayed in Fig. 3, and this cannot but be viewed with the deepest concern. It is indeed startling when a country lying within one of the major oil palm belts of West Africa, and therefore of the world, finds it necessary to *import* palm oil. The reason for the change appears to be a labour shortage due, in its turn, to a changing social economy. It is possible to recognize a number of responsible factors, chief among which is the increasing tendency among tribal men to be attracted by steady work which offers a firm monetary reward without the occupational hazards of farming; this is, of course, one aspect of contemporary detribalization. While the men are absent, working on roads, bridges, various new building projects and in the employ of private, including trading, firms, the women and girls have less time to spare for farm work, and this represents a real loss of labour in a society which has traditionally made so much use of female labour. The labour force available is further diminished by the spread of education, for as more children attend school fewer can help on the farms. A few years ago it was a common sight in palm belt villages to see children sitting around cracking nuts and extracting kernels, but this is becoming far less usual; whatever may be the merits of a broadening educational network, it does mean the loss of a very large cheap labour force.

It is widely believed in Sierra Leone that illicit diamond digging is now claiming a very large number of men. The question is acute because diamonds are known to occur in riverine swamps almost everywhere in the country except, perhaps, in the northeast. Evidence of the wealth accruing from this activity is plain for all to see in the extraordinary numbers of expensive new cars and flashy clothes, in the enormous demand for the more expensive varieties of alcoholic drinks, and in the general rise in the cost of living. Indeed, it is said that salaried people in the Protectorate who do not participate in this traffic are hard put to it to make ends meet.

In these circumstances it is perhaps not surprising that many agricultural activities in Sierra Leone are today at a low ebb for lack of labour, and that output of only the more valuable agricultural products is increasing—this in its turn aggravating the shortage of primary foodstuffs.* It is difficult to see a way out of this difficulty, especially

* It has been necessary to import rice at the end of the dry season and during the rains for some years, whereas the export of coffee, which commands a good world price, has leapt up (exports in 1951, 3,194 lb., value £218; in 1954, 12,756,560 lb., value £862,892).

while the diamond digging continues. A greater degree of mechanization might help, and a significant pointer is to be found in the great demand (far exceeding supply) for small nut (oil palm) crackers of simple construction and easy to handle, run by a single cylinder petrol engine. One of these machines can crack five cwts. of unshelled nuts per hour. At the same time, the Agricultural Department is seeking to help by distributing improved varieties of oil palm (150,904 seedlings in 1953 alone), and in due course this should stimulate production. But the fact remains that the oil palm industry of Sierra Leone is at present under a shadow, when even pioneer oil mills (Fig. 1) are closing down because farmers will not bother to bring in for processing fruit which hangs from the palms around. It is to be hoped that this situation will soon work itself out, and that Sierra Leone will take its rightful place once again as an exporter of oil palm products.

REFERENCES

[1] R. Miller, "The climate of Nigeria," *Geography*, vol. xxxvii, 1952, p. 210.

[2] J. M. Waterson, "Observations on the influence of some ecological factors on the incidence of oil palm diseases in Nigeria," *Journal of the West African Institute for Oil Palm Research* (WAIFOR), Sept. 1953, p. 27.

[3] "The West African Institute for Oil Palm Research," Nigerian Information Service, Lagos, no date, probably 1955, p. 19. The coconut palm is said to give the next highest yield.

[4] R. M. Prothero, "Recent developments in Nigerian export crop production," *Geography*, vol. xl, 1955, p. 23. It must not be assumed from these figures alone that the pioneer mill is an economic proposition; this has still to be proved. The average extraction rate from a competently operated hand-press may well be as high as the average from a pioneer mill, while it is doubtful if a peasant economy can feed a mill to an economic level.

[5] E. W. Zimmermann, *World Resources and Industries*, New York, 1951, revised edition, pp. 260–1. Groundnut oil ranks as the most important.

[6] These figures refer to the years 1951–4, and have been calculated from statistics given in the *Monthly Bulletin of Agricultural Economics and Statistics*, F.A.O., April 1955, pp. 38–9.

[7] R. M. Prothero, *op. cit.*

[8] For example, L. D. Stamp, *Africa*, London, 1953, p. 290.

[9] H. R. Jarrett, "Lunsar. A study of an iron ore mining centre in Sierra Leone," *Econ. Geogr.*, vol. 32, 1956, pp. 153–61. For an excellent general account of the mineral resources see J. D. Pollett, "The geology and mineral resources of Sierra Leone," *Colonial Geology and Mineral Resources*, H.M.S.O., vol. 2, no. 1, 1951.

Air Photographs and Land Utilization Maps

R. R. RAWSON AND K. R. SEALY

FOR SEVERAL YEARS the Department of Geography of the London School of Economics has taken an active interest in the application of aerial photography to geographical studies. In 1946 a course in the geographical interpretation of air photographs was inaugurated on lines described in an earlier paper.[1] Several postgraduate students found it helpful in their research. Progress was hindered by the difficulty of obtaining extensive photographic cover. Photographs are too expensive to purchase in large numbers, and Government departments with libraries of photographs have understandably felt unable to release material for prolonged study elsewhere. However, in 1955 the Air Ministry made available air photographs of Cyprus which gave practically complete cover of the island. From this material a land utilization map* was prepared by five members of the Department of Geography in four weeks. A map prepared to a similar degree of accuracy and detail by ground survey methods would have occupied the same team for many months of costly field work. In view of the need for land utilization maps of inter-tropical under-developed areas, it is thought that the methods which have been applied to Cyprus would yield useful and rapid results, for example, in Monsoon Asia and Africa. The object of the present paper is to state the material requirements for such work and to describe, with special reference to Cyprus, the stages by which the maps can be prepared.

I. MATERIAL REQUIREMENTS

1. *Air photographs.* These should be vertical photographs with at least 60 per cent fore and aft overlap providing stereoscopic cover of the whole area. The larger the scale and the better the quality of the photographs, the greater will be the amount and accuracy of the land-use data that can be derived from them. 1/10,000 is generally regarded as the minimum suitable scale. The photographs of Cyprus ranged from 1/10,000 to 1/13,000 and for that area prints of smaller scale would have been of little use. Smaller scale photographs would be acceptable for areas where the land-use pattern is simpler. For example, in Malaya, where the cultivated land is practically all paddy, village garden, or plantation of rubber, coconut palm and oil palm, with no mixing of these five elements, prints of 1/30,000 scale would suffice. On the other hand, in east and central Africa where shifting agriculture is practised, several crops are interplanted and the patches of cultivation merge gradually into bush, photographs of scales larger than 1/10,000 would be needed. The photographs should be sharp in definition and free of cloud.

* *Land Utilization Map of Cyprus*, prepared under the direction of R. R. Rawson and K. R. Sealy, reviewed on p. 78 of this issue.

Oblique photographs are not essential. They are sometimes helpful in the interpretation of verticals. No obliques of Cyprus were available.

2. *Topographic maps.* The land-use data from the photographs should be plotted on the best topographic maps available. For areas in the United Kingdom one would use the Ordnance Survey 6-inch or 2½-inch maps on which field boundaries are marked. The best map of Cyprus is the 1/50,000 which records settlements, roads and tracks in fair detail but no field boundaries. In inter-tropical Africa serious difficulty would arise except in areas such as Rhodesia for which maps of 1/63,360 scale exist. For most of East Africa nothing larger than quarter-inch maps is available and these would be of too small a scale. In Malaya the principal areas of settlement have excellent 1-inch maps: the remainder is covered by quarter-inch maps.

3. *Stereoscopes.* The folding pocket stereoscope is adequate for interpretation of the photographs. Larger stereoscopes with binocular attachments are less convenient to use, and so far we have not found one instance in which the larger and more expensive instrument yielded more information.

II. STAGES IN THE PREPARATION OF A LAND UTILIZATION MAP

1. *Plotting the photographs.* The photographs are laid on a table in runs. The area covered by each run is plotted on the topographic map. If the numbers of the first and last prints and of every fifth or tenth print of each run are inserted in the appropriate places on the map, the subsequent selection of prints covering specific localities is made easier. The photostat copies of the master plots, such as those which usually accompany photographs taken by the Royal Air Force, are helpful but often inaccurate. When all the photographs are plotted, the maps reveal whether there are any gaps in the photographic cover, such as the small triangular area north of Famagusta on the Cyprus map, and also if any parts have been covered by more than one run of prints. Where there is cover from more than one run, the run with the best photographs is selected for interpretation.

2. *Interpretation of the photographs.* This demands a knowledge of photographic interpretation and first-hand experience of the type of landscape involved. The principal task is to discern the relationship between the actual landscape and the mosaic of grey patches on the photographs. The difference between the interpretation of topographic maps and the interpretation of photographs, and the errors that arise through lack of acquaintance with the ground, were discussed in an earlier paper.[2] In 1951, G. M. Howe published an account of his work on photographs of northwest Cardiganshire.[3] He had the advantage of easy access to the ground and was able to check his interpretation by field work in critical areas. His was an ideal arrangement, but field work is not essential provided the interpreters have detailed first-hand knowledge of the kind of landscape under review. For example, none of the five persons engaged on the Cyprus map had visited the island. Two had first-hand experience of various Mediterranean areas including Greece, Crete, Algeria and the Levant, and the other three worked under their supervision. A number of land utilization maps of small tracts in a thesis[4] by Dr. D. Christodoulou were helpful.

The Cyprus photographs, about 10,000 of them, were all examined stereoscopically. The land classification used is that proposed by the Old World Division of the World Land Use Survey with one modification.

Crop land (4) was divided into 4A (irrigated land) and 4B (unirrigated crop land).* The category of the land use was everywhere clear, except in a few instances where it was difficult to find a boundary between what was clearly scrub and adjacent areas of rough grazing with a scattering of olive or carob trees. The map has not been checked on the ground, but a report from Dr. Christodoulou who now holds the post of Land Consolidation Officer in the Department of Agriculture of Cyprus states that there can be no doubt that the distributions shown are accurate.

3. *Recording of the land-use data on topographic maps.* No attempt was made to record the data for individual fields because (a) the field boundaries do not appear on the 1/50,000 map and (b) the fields are so small that on reduction to 1/250,000 two adjacent fields of different land use could not be shown. The boundaries of the several kinds of land use on each print were sketched on the 1/50,000 map. For example, on one print three separate groups of irrigated fields would be recognized, the rest of the land being unimproved grazing. The three irrigated areas would be outlined carefully on the map and recorded thereon as 4A with the rest of the area as 6. Frequently one group of fields qualified for two categories and was recorded as both. For example, an irrigated area under an annual crop interplanted with a permanent tree crop such as citrus fruit or olive was noted as 3/4A. Traces showing the land-use boundaries together with rivers and principal roads were then made from each of the sixteen sheets of the 1/50,000 map.

4. *Preparation of the land utilization map from the* 1/50,000 *traces.* It was thought that the final map would be most convenient on a scale of 1/250,000. The sixteen traces were reduced photographically to that scale. The next task was to devise a scheme of shading for the map. The eleven land-use categories had to be shown distinctly, the eleven kinds of shading had to be such that they could be combined so as to record mixed categories, and on grounds of economy the scheme had to be principally in black and white to keep colour printing at a minimum. This was achieved by using only one colour block over the black and white base.

It is hoped that the publication of the Land Utilization Map of Cyprus will draw attention to the value of this kind of work, and that Government departments will be prepared to give geographers access to the vast quantity of air photographs that is known to exist. For example, large-scale cover of Burma was obtained for military purposes between 1943 and 1945, and

* The categories of land use recognized by the Old World Division of the World Land Use Survey are:—

1. Settlements and associated non-agricultural lands (*dark and light red*).
2. Horticulture (*deep purple*).
3. Tree and other perennial crops (*light purple*).
4. Cropland: (a) Continual and rotation cropping (*dark brown*).
   (b) Land rotation (*light brown*).
5. Improved permanent pasture (managed or enclosed) (*light green*).
6. Unimproved grazing land: (a) Used (*orange*).
   (b) Not used (*yellow*).
7. Woodlands: (a) Dense (*dark green*).
   (b) Open (*medium green*).
   (c) Scrub (*olive green*).
   (d) Swamp forests (*blue green*).
   (e) Cut over or burnt over forest areas (*green stipple*).
   (f) Forest with subsidiary cultivation (*green with brown dots*).
8. Swamps and marshes (fresh and salt-water, non-forested) (*blue*).
9. Unproductive land (*grey*).

extensive areas of enemy-occupied territory elsewhere were also photographed. This material, together with more recent photographs of colonial areas taken on a scale of about 1/30,000 for the Directorate of Colonial Surveys, would be useful for land-use study. The writers thank the Air Ministry for lending the photographs of Cyprus, and Professor L. Dudley Stamp and Dr. D. Christodoulou for their help and encouragement at all stages of the work.

REFERENCES

[1] R. R. Rawson and S. H. Beaver, "Aerial photography and geographical studies", *Geography*, vol. xxxii, 1947, p. 131.
[2] R. R. Rawson and S. H. Beaver, *op. cit.*, p. 133.
[3] G. M. Howe, "A note on the application of air photography to the agricultural geography of Northwest Cardiganshire", *Geography*, vol. xxxvi, 1951, pp. 15–20.
[4] D. Christodoulou, *The Evolution of the Rural Land Use Pattern in Cyprus*, Ph.D. (Arts) Thesis, University of London, 1955.

This Changing World

URBANIZATION AMONG THE SOUTH AFRICAN WHITE POPULATION

The first published reports on the South African 1951 census issued in 1955 reveal a considerable increase in urbanization among the white population, and among the Afrikaans-speaking white population in particular: 78 per cent of a white population of 2,642,713 was urban in 1951, against 75 per cent in 1946 and 67 per cent in 1936. Whereas the urban population grew by nearly 300,000 between 1946 and 1951, the rural population declined by 22,000. Yet in 1951 the whites formed only 38 per cent of the total urban population, compared with 40 per cent in 1946.

The steady northward movement of white population continued. The Transvaal fraction of the total white population grew from 45 per cent to 46 per cent; the Orange Free State and Natal fractions also gained slightly, and the Cape fraction fell from 37 per cent to 35 per cent. In 1951, 31 per cent of the whole white population lived on the Witwatersrand, in Pretoria and in Vereeniging-Vanderbijl Park. These southern Transvaal cities hold 820,000 whites; the whole of Natal, the Free State and the remainder of the Transvaal have only 886,000.

Among the white population, the proportion of Afrikaans- to English-speakers has remained relatively constant at 60/40 since 1936. This is due to English immigration before 1948, as the birth rate among Afrikaans-speakers has been estimated at 28·3 against 21·2 among English-speakers, and among young children there are just about twice as many Afrikaans- as English-speakers. There can be little doubt, therefore, that the proportion of Afrikaans-speakers in South Africa will increase steadily in the future.

The rural population is overwhelmingly Afrikaans—84 per cent in 1951, 87 per cent in 1936. A numerical increase of 7,000 in the English-speaking

rural population may well be due to urban settlement outside the boundaries of the defined urban areas; wealthy and almost wholly English-speaking outer suburbs of Durban, which have grown substantially in recent years, are in this category. The loss of rural Afrikaans-speaking population, however, is enormous. The actual loss since 1936 is 77,000, but since there was a natural increase of about 165,000 the total loss by migration must have been nearly 250,000, from only 553,000 in 1936.

This migration has been absorbed principally in the larger towns, and on the Witwatersrand. The Afrikaans-speaking urban population is now larger than the English, though in Johannesburg, Durban and Cape Town, English-speakers still form the large majority. Whereas Afrikaans-speakers formed a majority in only 3 of the 10 lesser Rand towns in 1936, in 1951 they outnumbered English-speakers in all of them, and in Kimberley, also, had doubled their 1936 proportion to reach equality. In Pretoria and Bloemfontein, the capitals of the two Boer republics, English-speakers have never formed a majority. The Afrikaans-English proportion remained static, or virtually static, only in Johannesburg, Durban, East London, Pietermaritzburg and Germiston. In all other large towns the movement was in favour of Afrikaans, except in Roodepoort-Maraisburg, where the English proportion was raised by suburban development from Johannesburg.

Ninety-one per cent of the English-speaking white population was urban in 1951, against 69 per cent of Afrikaans-speakers. These figures compare with 88 per cent and 48 per cent in 1936. Seventy-six per cent of English-speakers resided in the larger towns in 1951, and no less than 50 per cent were in Johannesburg, Cape Town and Durban alone. Thus while the urban proportion of all whites is higher than in any other Commonwealth country, this is especially so of English-speakers. This latter highly urbanized group is now being swamped in the cities by Afrikaans-speakers, who are also increasing more rapidly in the country as a whole. These facts throw considerable light on South African political evolution in recent years.

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THE DEVELOPMENT OF THE PORTS OF EAST PAKISTAN

The influence of political events is rarely visible in the landscape but the partition of India in August 1947 provides an example of a political action which has induced great changes in some parts of the countryside. This note is concerned with the effect of partition on the development of the ports of the eastern wing of Pakistan.

In the years before the 1939–45 war the port of Chittagong was unimportant. It lay some ten miles up the Karnaphuli River, the winding estuary of which suffered from a large tidal range, very strong currents and a bar at its mouth and its advantages as a port site were not great. As long as Bengal was one political unit, Calcutta could provide all the facilities required for handling the overseas trade of the area. Thus in the decade 1924–5 to 1933–4 the value of imports into Chittagong was only 2·25 per cent of the value of imports into Calcutta, while exports (including re-exports) amounted to only just over 8 per cent of those of Calcutta.

Partition erected an artificial barrier between East and West Bengal so that the sea-borne trade of the former could no longer go through the port of Calcutta. Though small, poorly equipped, and with inadequate rail communications with the rest of East Bengal, Chittagong was the only port then available for handling the sea-borne trade of the area. The need to increase its capacity was thus urgent and a development plan to cost approximately eleven crores of rupees (about £8¼ million) was prepared. The first part of this plan was concerned mainly with the extension and reconstruction of existing jetties and storage sheds, and of the marshalling yard between Chittagong and Pahartali. The most important part of the development scheme, however, was the long-term plan, now nearing completion, for the construction of ten new permanent jetties. As a result, the port of Chittagong will be able to handle twenty ships at a time instead of the five that could be dealt with simultaneously at the time of partition and its annual capacity will have been raised from about half-a-million to over two million tons of cargo. Furthermore, a new oil installation to serve as a distribution centre for petroleum products throughout East Pakistan is now being completed at Chittagong for the Standard Vacuum Oil Company, while the largest oil storage tank in East Bengal, with a capacity of three million gallons, is under construction for the Burma Oil Company (Pakistan Trading) Ltd. on the Patenga peninsula (lying between the Karnaphuli River and the Bay of Bengal) where there will eventually be an installation capable of storing eighteen million gallons of petroleum products. Attention has also been directed to facilitating navigation in the estuary—not only has the dredger *Patunga* been fitted with a special suction-cutter to enable her to deal more effectively with the hard clay of the Ring Bar but a new grab hopper-dredger, *Karnafuli*, has recently reached Chittagong where she will be used primarily for improving and maintaining the depth of water off the jetties.

As a result of both these developments and the changed political conditions in Bengal the amount of traffic handled by the port has increased very greatly, as the following tonnage figures show:—

Year	*Imports*	*Exports*	*Total*
1947–48	Not available		421,000
1948–49	414,000	253,000	667,000
1949–50	786,000	299,000	1,085,000
1950–51	1,269,000	426,000	1,695,000
1951–52	1,204,000	445,000	1,649,000
1952–53	1,213,000	490,000	1,703,000
1953–54	1,006,000	526,000	1,532,000
1954–55	913,000	502,000	1,415,000
1955–56	998,000	537,000	1,535,000

The fall in total tonnage handled in the last few years results partly from the operation of various import restrictions.

In spite of the efforts made after partition to increase the capacity of Chittagong it was soon realized that these would be insufficient to meet the full needs of East Pakistan. A survey of the Ganges–Brahmaputra distributaries in East Pakistan revealed that the Pussur River was probably the most suitable for navigation by ocean-going ships and was, in fact, navigable as far as Chalna, some eighty miles from the sea. Chalna Anchorage was therefore established experimentally in December, 1950, to relieve congestion at Chittagong and provide an outlet for that part of East Pakistan lying west of the main Ganges–Brahmaputra. Results were so successful that in 1952

it was decided to maintain the anchorage on a permanent basis. Partly because of the need for expansion and partly because of the formation of strong eddies in the river during the monsoon, it was later decided to move the anchorage (which retained its original name after the move) some ten miles down-stream to Mongla where it was established in June, 1954. By the beginning of 1956 the number of moorings laid at Chalna Anchorage had been raised to eight and considerable expansion had also taken place in providing ancillary services. The development of Chalna Anchorage since its inception can be seen from the following figures of tonnage handled:—

Year	*Imports*	*Exports*	*Total*
1950–51 (3½ months only)	1,000	32,000	33,000
1951–52	130,000	218,000	348,000
1952–53	147,000	281,000	428,000
1953–54	118,000	324,000	442,000
1954–55	95,000	393,000	488,000
1955–56	67,000	503,000	570,000

This new port thus handles more merchandise now than passed through Chittagong at the time of partition.

It would seem that the planned developments at Chittagong and Chalna, enabling them to deal respectively with about two million and half-a-million tons of goods a year, will enable East Pakistan to overcome the problems of overseas trade that resulted from partition, unless or until some substantial increase occurs in the volume of East Pakistan's seaborne imports or exports.

(Information partly from the Office of the High Commissioner for Pakistan.)

University of Sheffield. I. S. Maxwell.

EDITORIAL NOTICE

The Honorary Editor has pleasure in announcing that Dr. G. J. Butland has accepted an invitation to become editor of the feature "This Changing World," in succession to Mr. L. S. Suggate. Contributors to "This Changing World" are asked to submit material for consideration to Dr. G. J. Butland, Department of Geography, University of Birmingham, 341 Bristol Road, Birmingham 5.

The Geographical Association

ANNUAL REPORT 1956

With the close of the year our first and very pleasant duty is to express sincere thanks to our distinguished retiring President, Lord Nathan, for the interest he has taken in our affairs; despite the very considerable public demands on his time, he has made opportunities to join us and meet members personally at both the Spring Conference held at Brighton and the Summer School in Guernsey. Both his and Lady Nathan's kindness on these occasions will long be remembered. Our immediate past-President, Mr. Suggate, has given invaluable help once again during the year, in directing our committees and we shall miss his wise counsel greatly now that he has emigrated to New Zealand. Our very best wishes go to him and Mrs. Suggate.

Lord Nathan is succeeded in office by one of our senior members who is widely known within the Association. We extend to our good friend, Professor P. W. Bryan, a specially warm welcome in his year of office.

The past year has shown a steady continuation of the recent trend towards a small increase in membership, which at the close of the year was 4,109 as compared with 3,781 in 1955. We would urge our student members to make a special effort to continue to support the Association, as full members, when they leave their college or university. As student members they have been privileged and their special subscription rate is financially not self-supporting. We need, in return, their full support in the ensuing years, and we would especially welcome the co-operation of many more in this respect.

There has been much activity throughout the year in all fields of the Association's work. There are now branches in 52 centres; three new branches have been formed and one affiliated group has withdrawn. The majority of branch reports refer to successful programmes of lectures, field studies, excursions and joint branch activities. Some of these (e.g., the joint meeting of Tees-side Branch and a Durham group for a lecture from the Bishop of Blackburn on "Religion in Melanesia") reflect wide interests; the Northern Ireland Branch has extended the local work of the Land Use Survey; members of the Edinburgh Branch have participated in the publication of a new textbook of Scottish geography; the Liverpool Branch continues to organize Merseyside steamer trips for schoolchildren literally "by the thousand". These are but a few of the many varied events recorded over the country as a whole.

We have had requests for affiliation from several overseas groups of geography teachers (in Nairobi, Sierra Leone, and Jamaica). As yet little progress has been possible in the formal establishment of an Association of Commonwealth Geographers, largely because of the heavy expenditure involved in initial development; but we hope to develop this scheme in due course.

The year has had some quite outstanding conferences and courses. The Annual Conference in January under the direction of our very able conference organizer, Mr. R. C. Honeybone, was one of the best we have ever had, with a general theme of the Geography of the London Basin. The Spring Conference organized by the Brighton Branch and Mr. A. H. Fry (conference secretary) brought a record number of members to the meetings, and we are greatly indebted to the local committee for the excellent arrangements made. Two summer schools were held, one in Guernsey led by our indefatigable friend, Dr. E. W. H. Briault; the other was at Exeter, where, under the leadership of two university geographers, Mr. R. S. Waters and Mr. R. A. G. Savigear, assisted by Mr. G. C. Chapman representing the schools, a small group of teachers was given specialist training in field work in geomorphology. Judging from the letters received at headquarters both schools were an outstanding success and were greatly appreciated by the participants, and we extend warm thanks to the leaders for their help and the generous expenditure of their time.

During the annual meeting of the British Association for the Advancement of Science in Sheffield we entertained at headquarters about 100 visitors (including members and non-members) to tea and to view an exhibition of nineteenth and twentieth century textbooks of geography. We are very grateful to the Royal Geographical Society for the loan of some earlier texts for this exhibition and to our Honorary Librarian, Mr. L. J. Jay, for his work in preparing and annotating the exhibits.

Your officers have also been concerned with the initial preparations for next year's activities which include a Spring meeting to be held at Matlock and summer schools at Aix-en-Provence and in Warwickshire (the latter with special reference to historical geography). As the founder Association of the International Union of Associations of Teachers of Geography we have also been concerned with the preliminary work in the organization of the Third Conference of the Union, which is to be held next year at Grenoble under the auspices of the Société Française des Professeurs de Géographie. The organization of summer meetings and courses now seems to be a well-established custom appreciated by members. It would assist us greatly in our endeavours to meet and to anticipate members' needs if more members would let us know what kind of meeting and venue is preferred. Especially in the case of foreign courses, we need very early registration by members so that adequate reservations are made.

The various committees of the Association report much activity, and the following notes indicate the main, but by no means entire, business conducted during the year.

The *Executive Committee* has made special efforts to gain from Local Education Authorities more general recognition of our courses and conferences as educational meetings for attendance at which members may qualify for grants towards expenses. All local authorities have been reminded of our work. On the instruction of the committee, a reprint of Mr. Suggate's Presidential Address, "Geography Teaching in Grammar Schools" has been sent to the headmaster or headmistress of every grammar or public school in the country in an endeavour to help, where need be, the status of our subject in all these schools.

In collaboration with the Section Committee for Further Education the executive committee has considered the recent White Paper on Technical Education issued by the Ministry of Education, and the need to take action to safeguard the standing of our subject at this level during the development of technological education. The committee is also collaborating with the Secondary Schools Section Committee with respect to the work of the recently reconstituted Central Advisory Council of the Ministry of Education, and a G.A. sub-committee is now collecting evidence regarding the educational importance of our subject. We have asked the Ministry to allow us to submit this evidence early next year so that the claims of geography are placed before the members of the Central Advisory Council which is now engaged in the significant task of considering ". . . in relation to the changing social and industrial needs of our society the needs of its individual citizens, the education of boys and girls between 15 and 18, and in particular the balance at various levels of general and specialized studies between these ages . . ." (Parliamentary reply from the Minister of Education).

In an endeavour to obtain and maintain closer liaison with the Ministry at all times, we have requested that one of H.M. Inspectors should attend meetings of the executive committee as an observer. To this the Ministry has willingly agreed, and we are very glad to welcome Mr. E. C. Marchant, H.M.I. in this capacity.

Acting in consultation with both the standing Committee for Visual Aids and the Secondary Schools Section Committee, we have also given much thought to the content and format of an entirely new teaching set of O.S. map extracts, with accompanying illustrations, which it is hoped ultimately to publish.

The *Secondary Schools Section Committee* reports the holding of several meetings which have included discussion on geography in technical schools, field work, sample studies, G.C.E. " O " level papers, geography in the modern school (jointly with the Training Colleges Section), etc. Apart from the preparation of evidence for the Central Advisory Council of the Ministry of Education (as noted above) the section committee has also devoted much time to the preparation of a questionnaire which it is hoped to circulate shortly to members, and others, in an endeavour to determine to what extent old and new school buildings (and schools yet to be built) have adequate provision in space and equipment for geography rooms and laboratories.

Further Education Section Committee. The uncertain future status of the subject in technical colleges (as indicated by the recent Government White Paper) has been studied and a memorandum prepared. The chairman of the section is a member of the sub-committee of the executive committee which is preparing evidence on behalf of secondary schools and further education institutes and colleges.

Newsletters to members have again been circulated. A sub-committee has been working on the analysis of some sixty different courses in geography for professional examinations, which lecturers in colleges and institutes may have to organize. It is hoped to devise a common basis for some of these.

The *Public and Preparatory Schools Section Committee* has not held meetings this year other than those in the course of the Annual Conference, but a sub-committee has been active with regard to common entrance examinations to public schools.

The *Primary Schools Section Committee*, working in collaboration with the Training Colleges Section, is preparing a new handbook on the teaching of geography in junior schools. It is anticipated that publication of this new aid to teachers and students will be completed in 1957.

The *Training Colleges Section Committee* reports the holding of three short conferences during the year, two in London and one in Cambridge. The main matters for discussion have been concerned with the content and syllabuses in the proposed new three-year courses in geography at training colleges. The picture-research project launched in 1954 has now reached the stage when results can be analysed and it is hoped that by the end of 1957 a summary will be available. To Miss Carr and the members of the research committee we extend special thanks for the organization of important schemes of work of this kind.

The *Standing Committee for Visual Aids in the Teaching of Geography* has had a busy year. A larger number of enquiries than usual has been received and answered. Individual members of the committee continue to advise on film and film-strip production, and one member has compiled a catalogue of sources of display material for teaching. Meetings of the committee have been concerned with the selection of map extracts for the proposed new teaching set, and the selection of films and mounting of another exhibition of visual aids and equipment at the Annual Conference. The help of the Educational Foundation for Visual Aids in this last matter is gratefully acknowledged.

The *Standing Committee for Urban Spheres of Influence* reports a year of work spent mainly in filling gaps in some counties already dealt with (e.g., Lincolnshire). In Scotland the survey has been extended to cover a group of southeastern counties, the coverage of this area being organized from the Social Sciences Research Centre at Edinburgh.

The *Standing Committee for Field Studies* has been actively concerned with the basic organization of the summer schools, the initial routine preparations for courses in coming years and members' enquiries. Professor Wooldridge very generously found time to attend part of the Exeter Summer School for the study of geomorphology and contributed to the programme.

Our recognition of the work of the *Editorial Board* must not go unmarked. To the Honorary Editor, Professor D. L. Linton, our sincere thanks are especially recorded for the valuable issues of our journal that comprise the latest volume. We are very sorry to lose the help of Mr. Suggate as Editor of "This Changing World," which office he held since the inception of the feature, now a most valuable—and, we hope, permanent—part of *Geography*. It was hoped that, with the increase in the subscription, it might have been possible to increase the size of *Geography*, but, as our revenue account shows painfully clearly, the rises in the cost of printing, paper, and blocks make such action at present beyond our means.

Finance Sub-Committee. This is the first full year during which the new subscription rate has operated. It is a matter of very keen regret that the Finance sub-committee still finds itself unable to report favourably on the financial position. As the Balance Sheet shows, two items alone—increases in printing costs, and the need to increase the wages and salaries of our very hardworking staff nearer, if not precisely up to, the national scales now operating—go a long way towards explaining the fact that already the increase in income has been offset by rising expenditure, and your officers are still in the position of having to search for further considerable sources of income beyond that derived from subscriptions. Unsuccessful application for financial help towards publication expenses was made to the Nuffield Foundation. Members can greatly help us to resolve this recurring financial difficulty by maintaining their own subscriptions, and also by helping actively to recruit new members.

The work in so many fields of geographical education now undertaken by such a large number of our members calls for increasing endeavours by our very small but exceedingly loyal staff, and we take no little pride at headquarters in the vigorous life within our Association. Despite the very large number of persons to whom acknowledgment and thanks should be extended—and the names are indeed legion—your Honorary Secretary proposes this year, in view of special circumstances, to make reference to the name of only one person.

Before the next Annual Report has to be presented, Professor H. J. Fleure will complete his eightieth year, and the same year will mark the fortieth year of his service to the Association; he took office first as Honorary Secretary in 1917, later became Vice-president, then President and he is now Chairman of Council. His arduous labours during those earlier and acutely penurious days built the Association into the vigorous and powerful organization that it has now come to be, and simultaneously did quite immeasurable good for the status of geography in education. His wise counsel and help are still freely given. On behalf of every member, therefore, we send him affectionate greetings and advance good wishes on the occasion of his next birthday.

ALICE GARNETT
Honorary Secretary

December 1956

ELECTION OF PRESIDENT FOR 1958

At its meeting on 1st January, Council elected with acclamation our good friend and a distinguished geographer, Professor R. Ogilvie Buchanan, of the London School of Economics, as President for 1958.

ELECTIONS TO COUNCIL

At the Annual General Meeting of 2nd January, the following members were elected to fill vacancies on Council: Mr. H. King (Liverpool Branch), Professor Norman Pye (University College of Leicester), Mr. W. H. Shepherd (Manchester Branch) and Mr. J. G. Skinner (Southwest Essex Branch). Mr. King was elected by Council to serve on the executive committee.

ANNUAL CONFERENCE, 1ST TO 4TH JANUARY 1957

Under the able direction of Mr. R. C. Honeybone and Dr. J. H. Bird, the meetings held in London this year were once again a great success. Most lectures were

attended by about 400 members; lecture theatres and the hall of residence that has been placed at our disposal in recent years were filled to capacity. We are greatly indebted to the London School of Economics and to University College for this accommodation.

Our programme included the Presidential Address given by Lord Nathan to a joint meeting of the Royal Geographical Society, the Institute of British Geographers and the Geographical Association, at the House of the Society, which once again generously entertained us to tea after the lecture. Linked with the address, on "World Aviation and Geography," was an excursion later in the week to London's airports, led by Mr. K. R. Sealy.

Professor W. G. V. Balchin opened the meetings with a stimulating lecture on the nation's water supply. Mr. H. A. Warren, of Southeast London Technical Institute, and Dr. E. W. H. Briault, Deputy Education Officer for L.C.C., spoke at a meeting on "Geography and a Liberal Education," giving forthright statements of views on this relevant topic. Professor R. Ogilvie Buchanan gave his impressions of the economic development of Brazil, which he visited during the I.G.U. Congress in 1956, and Professor D. L. Linton reviewed the rôle of our subject in relation to the present social revolution.

To a lecture by Mr. J. T. Coppock on agricultural changes in the Chilterns there was linked an excursion to the region he had discussed. Other excursions included one by Mr. H. C. Wilks, taking members over the ground on which a demonstration lesson (with boys from Norbury Manor School) had been based; this lesson was observed by about 350 members. Field work carried out by our members last summer was described by Dr. Briault in a review of the Summer School in Guernsey.

Current exploration and discovery were considered by Mr. E. W. K. Walton, in a lecture both popular and very well illustrated describing Antarctic exploration, and by Mr. D. C. Martin, Assistant Secretary of the Royal Society, who spoke about the International Geophysical Year. Sir James Wordie introduced " South," the 42-year-old film of the Shackleton Antarctic Expedition of 1914–16, of which he was himself a member.

We extend our warmest thanks to the many who contributed to this excellent annual meeting and, not least, to our two very hard-worked organizers. The annual dinner and reception was greatly enjoyed by 100 members.

SPRING CONFERENCE 1957

The Spring Conference, organized as a study course for teachers, will be held at Matlock from 23rd to 27th April. Programmes and application forms have already been sent to all members, and anyone who wishes to attend the meeting who has not already returned the application form is urged to do so at once. Inquiries should be addressed to the Conference Organizer, Miss M. Oughton, Geographical Association, c/o The Park Branch Library, Duke Street, Sheffield 2.

Owing to the present petrol restrictions, it has been decided that the Herbertson Memorial Lecture shall be given at Matlock and not in Sheffield, and that there will not be a general meeting and dinner in Sheffield as part of the Conference arrangements. Members who wish to attend the Memorial Lecture but who do not wish to participate in the Spring Conference will be welcomed at Matlock. They should advise the Conference Organizer so that adequate seating arrangements may be made. The Lecture will be given by Professor L. Dudley Stamp, on "Major Natural Regions: Herbertson after Fifty Years."

SPRING CONFERENCE 1958

It is proposed to hold the Spring Conference in 1958 at Aberystwyth under the direction of Professor E. G. Bowen. The conference will provide members with a unique opportunity to study the west Welsh highland region.

SUMMER SCHOOLS 1957

Members who wish to register for any of the summer meetings should do so without delay. Anyone who has not received a copy of the preliminary notices already circulated should apply to the Assistant Secretary at headquarters. The dates of the meetings will be: Provence (leader: Professor A. E. Smailes), 8th to 23rd August; Historical Geography at Barford, Warwickshire (leader: Dr. H. Thorpe), 3rd to 17th August; Third International Conference of Teachers of Geography at Grenoble, 25th to 31st August. The Geographical Association will be well represented at the International Conference and a travelling party will probably be arranged from London to secure fare reductions.

SUMMER SCHOOLS 1958

After further exhaustive efforts to find suitable accommodation, it has been decided, with reluctance, to abandon hope of organizing a Summer School in Brittany. Plans for two other meetings in 1958 are now in hand.

Professor Bowen has kindly agreed to organize and lead a Summer School to be held at the new field Study Centre at Preston Montford, near Shrewsbury. Since this course will follow the Spring Conference at Aberystwyth in 1958, the two meetings are being arranged as complementary study courses, to view under Professor Bowen's expert guidance the Welsh highlands from both the western and the eastern marginal zones. We are greatly indebted to him for the promise of two very stimulating meetings next year.

An overseas course is being planned in Germany (Rheinland) under the leadership of Mr. T. H. Elkins and Mr. E. M. Yates, of King's College, London. It is intended to study the Ruhr and the industrial Rhine valley and the Coblenz and Eifel areas. Further information about both schools will be published later this year.

ANNUAL CONFERENCE 1958

The Annual Conference will be held in London from 31st December 1957 to 3rd January 1958. Residential facilities will again be available at Campbell Hall, and, if there is sufficient demand, at another Hall of Residence. The programme will be circulated to members of the Association in November 1957.

FIELD WORK CENTRES FOR SCHOOLS

The Standing Committee for Field Studies proposes to compile a record of field centres which could be consulted by members of the Association planning school journeys and geographical study courses. Such information is not readily available from any single source in the detail which is usually required and members who have organized field weeks or weekends for their pupils could help greatly by making recommendations for inclusion in the list. Members who are willing to contribute information about field centres, hostels, guest houses, etc., suitable for school parties are invited to apply to headquarters for a form (or forms) on which the necessary specific details can be entered. The experience of teachers who have already undertaken school field work organization may be used to the benefit of many members by the interchange of information thus provided.

G.A. REPRINTS AND PUBLICATIONS

Attention is drawn to the reprints and other publications of the Association listed on the inside front cover of the journal. Members who have only recently joined the Association are especially recommended to notice the reprints now available, in which are to be found articles of special interest from recent volumes of *Geography*.

THE WILFRED SMITH MEMORIAL FUND

A fund has been established to create a permanent memorial to the work of the late Professor Wilfred Smith, who during the period 1950 to 1955 held the John

THE GEOGRAPHICAL ASSOCIATION

Dr. **ACCUMULATED FUND—INCOME AND EXPENDITURE ACCOUNT for the year ended 31st August, 1956** *Cr.*

	£ s. d.	£ s. d.	1955 £
To *Geography*			
Printing and Publishing		2,038 12 3	1,491
Blocks	73 10 5		
Less Author's Contributions	26 18 8		
	46 11 9		97
Postages	219 11 4		118
		2,304 15 4	1,706
„ Special Publications			
Stock at 1st September, 1955	216 7 9		176
Printing	147 19 6		
Less Receipts from Advertisements	— — —		
	147 19 6		158
	364 7 3		334
Less Stock on Hand 31st August, 1956	245 14 4		216
		118 12 11	118
„ Printing and Stationery		425 17 10	244
„ Addressograph		19 9 10	19
„ Insurance		20 13 7	8
„ Salaries and National Insurance		1,501 19 9	1,265
„ Staff Superannuation and Pension Scheme		49 14 2	133
„ Postages—General		281 10 10	216
„ Sundry Office Expenses		44 11 2	35
„ Library Expenses		36 18 9	37
„ Telephone		29 7 1	28
„ Bank Charges		17 13 6	22
„ Publicity		134 6 8	—
„ Officers' and Standing Committee Expenses		111 5 8	147
„ Branch Secretaries' Conference		— — —	51
„ Donations and Subscriptions		15 0	1
„ Accountancy Charges		42 0 0	30
„ Subvention to Branches		33 16 0	34
„ Depreciation of Office and Library Furniture and Equipment		39 13 4	44
		£5,213 1 5	£4,138

	£ s. d.	£ s. d.	1955 £
By Sales of Publications etc. and Royalties		380 16 11	427
„ Sales of Special Publications		301 10 8	333
„ Advertisements		419 14 3	355
„ Returned Library Postages		47 8 1	38
„ Closed Branches—Surplus Funds		— — —	4
„ Subscriptions			
Current	3,361 2 4		2,515
Refund of Income Tax on Covenanted Subscriptions	133 11 9		136
Arrears	13 6 0		11
		3,508 0 1	2,662
„ Interest on Investment and Building Society Deposits (Investments and Deposits held in Life Membership and Accumulated Funds)			
On Government Stocks (Gross)	70 6 8		70
On Preference Shares (Gross)	74 15 0		18
On Building Society Deposits	34 16 8		48
		179 18 4	136
„ Surplus on Conferences		73 16 10	37
„ Donations to Library		— — —	12
„ Gifts		90 12 11	58
„ Exchange of Publications (U.S.A. Subscriptions)		7 7 0	18
„ Refund of Costs of Distribution of *Geographers' Reference Book* on behalf of the Geographical Handbook Committee		90 0 0	—
Balance—Excess of Expenditure over Income for the year carried to Accumulated Fund		113 16 4	58
		£5,213 1 5	£4,138

THE GEOGRAPHICAL ASSOCIATION

Dr. **MISCELLANEOUS MAPS ACCOUNT—INCOME AND EXPENDITURE ACCOUNT for the year ended 31st August, 1956** *Cr.*

	£ s. d.	1955 £		£ s. d.	1955 £
To Stock at 1st September, 1955	107 19 7	153	By Sales	290 3 2	283
„ Maps Purchased	57 0 1	91	„ Stock 31st August, 1956	34 6 4	108
„ Depreciation of Duplicator	2 10 5	3			
„ Balance, being excess of Income over Expenditure, transferred to the Publications Reserve Fund	156 19 5	144			
	£324 9 6	£391		£324 9 6	£391

BALANCE SHEET **31st August, 1956**

	£ s. d.	£ s. d.	1955 £		£ s. d.	£ s. d.	1955 £
ACCUMULATED FUND				ACCUMULATED FUND ASSETS			
Balance as at 31st August, 1955	199 12 9		257	Debtors			
Less Deficit for the year as per Income and Expenditure Account	113 16 4	(Deficit) —58		Summer School Account	86 14 8		312
		85 16 5	199	Sundry	290 16 6		316
GENERAL RESERVE		690 11 6	691				628
SUBSCRIPTIONS PAID IN ADVANCE	209 4 4		453	Stock of Special Publications	377 11 2		216
SUNDRY CREDITORS				OFFICE AND LIBRARY FURNITURE AND EQUIPMENT	245 14 4		
Geography 2 Issues	959 4 0		753	Estimated Value 31st August 1951	150 0 0		
Superannuation	2 4 0		104	Additions since	351 3 0		
Summer School	100 3 10		52		501 3 0		
Sundry	484 8 0		195	*Less* Depreciation to date	144 2 9		
	1545 19 10				357 0 3		394
		1,755 4 2		INVESTMENTS			
				£200 3% Savings Bonds 1965/75 at par (Market Value 31st August, 1956 £147 0 0)	200 0 0		200
				Cave Austin & Co. Limited—248 5% Cumulative Preference Shares of £1 each, at cost	190 10 6		191
				Cash in Hand	101 7 8		
				Cash at Building Society	975 0 2		
				Cash at Bank	84 8 0		
					1,160 15 10		818
						2,531 12 1	
Carried forward		£2,531 12 1	£2,447	Carried forward		£2,531 12 1	£2,447

BALANCE SHEET—CONTINUED

31st August, 1956

	£ s. d.	£ s. d.	1955 £
Brought forward		2,531 12 1	2,447
PUBLICATIONS RESERVE FUND			
Balance as at 31st August, 1955	1,235 11 1		1,069
Add Surplus on Map Sales Account	156 19 5		144
Interest for the year	27 1 7		23
	1,419 12 1		1,236
SUNDRY CREDITORS	12 10 7		26
		1,432 2 8	1,262
LIFE MEMBERSHIP SUBSCRIPTION FUND			
Balance as at 31st August, 1955	2,953 18 9		2,871
Add Subscriptions received during the year	55 19 11		83
		3,009 18 8	2,954
JUBILEE FUND			
Balance as at 31st August, 1955	943 18 6		917
Add Interest for the year	28 0 8		27
		971 19 2	944
Carried forward		£7,945 12 7	£7,607

	£ s. d.	£ s. d.	1955 £
Brought forward		2,531 12 1	2,447
PUBLICATIONS RESERVE FUND ASSETS			
Duplicator, at cost	32 3 2		
Less Depreciation	17 17 7		
	14 5 7		17
Stock—Map Sets	34 6 4		108
Sundry Debtors	38 4 8		55
Cash at Building Society	916 18 6		
Cash at Bank	428 7 7		
	1,345 6 1		1,082
		1,432 2 8	1,262
LIFE MEMBERSHIP SUBSCRIPTION FUND ASSETS			
Investments			
£1,646 4s. 2d. 3% Savings Bonds 1965/75	1,646 4 2		
£300 0s. 0d. 3% Savings Bonds 1955/65	300 0 0		
	1,946 4 2		1,946
£170 0s. 0d. 3½% Defence Bonds (Conversion Issue) 1964	170 0 0		170
	2,116 4 2		2,116
Cave Austin & Co. Limited—985 5% Cumulative Preference Shares of £1 each at cost	755 4 7		755
Cash at Building Society	116 6 9		
Cash at Bank	22 3 2		
	138 9 11		83
		3,009 18 8	2,954
JUBILEE FUND ASSETS			
Investment, at par			
£820 0s. 0d. 3% Savings Bonds 1965/75 (Market Value 31st August, 1956, £602 14 0.)	820 0 0		820
Cash at Building Society	127 7 2		
Cash at Bank	24 12 0		
	151 19 2		124
		971 19 2	944
Carried forward		£7,945 12 7	£7,607

THE GEOGRAPHICAL ASSOCIATION

BALANCE SHEET—CONTINUED — **31st August, 1956**

	£ s. d.	£ s. d.	1955 £
Brought forward		7,945 12 7	7,607
HERBERTSON MEMORIAL FUND			
Balance as at 31st August, 1955	296 19 2		289
Add Interest for the year	8 16 2		8
		305 15 4	297
		£8,251 7 11	£7,904

	£ s. d.	£ s. d.	1955 £
Brought forward		7,945 12 7	7,607
HERBERTSON MEMORIAL FUND ASSETS			
Investment, at par			
£250 0s. 0d. 3% Savings Bonds 1965/75	250 0 0		250
(Market Value 31st August, 1956, £183 15s. 0d.)			
Cash at Building Society	48 5 4		
Cash at Bank	7 10 0		
	55 15 4		47
		305 15 4	297
		£8,251 7 11	£7,904

We have audited the above Balance Sheet, dated 31st August, 1956, and certify that in our opinion it is properly drawn up so as to exhibit a true and correct view of the position of the Association at that date, according to the best of our information, and the explanations given to us, and as shown by the books of the Association.

SHEFFIELD,
29th October, 1956.

(*Signed*) HOLMES, WIDLAKE & GIBSON,
Chartered Accountants.

L. DUDLEY STAMP,
Honorary Treasurer.

Rankin Chair of Geography in the University of Liverpool and who was President of the Liverpool Branch of the Geographical Association. Friends and old students of Professor Smith are invited to contribute. Cheques and postal orders should be made payable to the Wilfred Smith Memorial Fund, and sent to the Honorary Treasurer, Mr. E. S. Simpson, 12 Abercromby Square, Liverpool 7.

A MAP OF ANTARCTICA

The American Geographical Society has published a map of Antarctica at a scale of 1 : 6,000,000 (in latitude 71°; stereographic projection) which would be useful to teachers and others engaged in projects connected with the International Geophysical Year 1957–8; or indeed to anyone who is interested in the progress of the current explorations and activities on the south polar continent. The map, about 40 inches square and printed in black and white, oceans in blue, shows the multitude of names fringing the continent, some approximate contours and estimated and surveyed elevations. Inset maps illustrate the mapping of Antarctica as at December 1955 (scale 1 : 36,000,000) and Antarctica in relation to the other continents on a polar azimuthal equal-area projection, scale 1 : 152,000,000, with limits of pack ice and icebergs. The map costs $1 (payable in U.S. currency); the address of the American Geographical Society is Broadway at 156th Street, New York 32, N.Y., U.S.A.

FILMSTRIP PREVIEW SERVICE

Messrs. Educational Productions Ltd. of East Ardsley, Wakefield, Yorks., have recently announced details of a free Dual Preview Service of educational filmstrips, which is available to all educational authorities and schools throughout the world. The 1957 catalogue of filmstrips and full details of the preview system are available on request from the publishers.

Reviews of Books

With very rare exceptions, books reviewed in this journal may be borrowed from the Library by full members or student library members of the Association.

The Geographer as Scientist. S. W. Wooldridge. 14·5 × 22·5 cm. xii + 299 pp. Edinburgh: Thomas Nelson and Sons Ltd. 1956. 35s.

This book offers a welcome opportunity for a colleaguely tribute rather than an occasion for a review taking up small points. Wooldridge has long been known and respected as a stalwart defender of real earthiness in the study of geography, alike in research and in teaching. Some of us do not adopt quite the same balance of emphasis, but we agree that one must not take either the *ge-* or the *he* out of our work. It is an outstanding feature of Wooldridge's personality that he speaks of what he has come to know through the soles of his boots, of the London Basin and the southeast of England; and those of us who are trying to understand Anglo-Saxon England find his eassys not only solidly helpful but also stimulating. If he would some day venture further into the social-historical side of the southeastern region, the outcome might be a brilliant light in some still dim corners. Wooldridge will like to be called a disciple of William Morris Davis even if this tribute comes from one who is perhaps rather a follower of Vidal de la Blache and F. von Richtofen. All these and we are followers of Suess. Wooldridge is a geneticist of landforms with a healthy outlook towards their functions in relation to man. The maps and paragraphs on Essex are specially attractive in this connection as that area has somehow not had quite the attention that East Anglia and the Downlands have enjoyed. Let us all try to find a balance of emphasis in our geography that not only suits our

individual minds, but promotes the use of geography as a means of general liberal education and synthetic research. Whatever our special field, it is the genetic approach that matters. Everything, everywhere is "becoming".

H. J. F.

Land Utilization Map of Cyprus. R. R. Rawson and K. R. Sealy and others, for the World Land Use Survey. 1 : 250,000. Paper, folded, 35 × 22 ins. Geographical Publications Ltd., Bude and London. 1956. 3s.

This map, prepared in the Department of Geography of the London School of Economics, is the first to be published for the Old World Division of the World Land Use Survey, and offers a valuable and encouraging basis for future work. It was constructed by stereoscopic examination of air photographs, taken in 1949 on scales between 1/10,000 and 1/13,000, details of land use being plotted on the 1/50,000 topographical map of Cyprus and reduced to a scale of 1/250,000. Sample areas of ground survey were used to check the accuracy of photographic interpretation. Land use is classified in eleven types, based on those proposed for the Old World Division of the W.L.U.S., and it was possible here to subdivide crop land (Type 4) into irrigated and unirrigated. Combined symbols show land with two uses, as where permanent tree crops are grown with irrigated annual crops. The same use of combined symbols where distinction of separate categories of land is precluded only by scale may be misleading, but this cartographic feature could easily be clarified by modification of the symbols. While the method of constructing a land-use map from air photographs has its own problems, much depending on the nature of the base map available, this map leaves no doubt about its advantages in territory where ground survey would make heavy demands on time and labour, either through extent of land to be covered, or, as in Cyprus, because land use is small-scale and intricate.

The map is a noteworthy contribution to the geography of Cyprus, a small, predominantly agricultural island of increasing population where the pattern of land use in relation to the physical background is of the utmost significance. To map the material of the 1946 Census of Agriculture is impossible, because the village unit bears little relationship to the ownership of land, 22 per cent of all the farmland being outside the village where the owner resides and for which his statistics are recorded, so that this map goes some way to meet a long-felt need. One fact strikingly clear is that virtually all the land is put to some use, there being only a few narrow coastal strips of unproductive land on cliff-tops or sand dunes. Detail in the map is the more reliable for the fact that the photographs were taken mostly in April, May and June, when winter crops were being harvested and summer crops sown. Difficulties in mapping the three categories of woodland, no less complicated in ground survey, have been met conservatively, and only areas of considerable extent with dense woodland appear as 7A. Cyprus forests do, however, illustrate one disadvantage in the use of air photographs, in that land in some stages of forest development may appear as unimproved grazing land or even as crop land, and official information is necessary for accurate classification of land use. It is, perhaps, unfortunate, for those concerned with analysis of land use in Cyprus, that the map has not been published on the scale of 1/253,440, which would have made possible direct comparison with other published maps of the island. But this is a minor point, and the authors and their assistants are to be congratulated on their pioneer achievement.

M. M.

I Porti della Toscana e del Lazio. *Memorie Di Geografia Economica*, vol. xiii. G. Barbieri. 18 × 25 cm. 176 pp. + 6 pl. Institute of Geography, University of Naples. 1955. Lire 2000 (about 23s.).

Much as Italy needs her receipts from tourists it is important for us to give more thought to her economic life, and here is a thoughtful study of the ports of Tuscany

and Latium, past and present. Livorno (Leghorn), much the most important, is studied at length from its rise under the early Florentine Medici, through the generations during which they ruled as Grand Dukes of Tuscany to the present day, and in its great growth since 1945, largely—perhaps too largely—based on imported oil. Civita Vecchia, with its more limited growth, has suffered in the 1939–45 war. The little ports of Elba and their Tuscan relatives are treated interestingly. Twelve photographs show features chiefly of the lesser ports. H. J. F.

Prato e La Sua Industria Tessile. Studi Geografici sulla Toscana: a supplement to *Rivista Geografica Italiana*, vol. lxiii, 1956. G. Barbieri. 17 × 24 cm. 70 pp.

Prato, northwest of Florence, a wool-town for centuries, has developed greatly since the 1939–45 war and is now very important, yet still characterized by a large number of small establishments engaged in one or two of the processes of production. The large factories are relatively few. Naturally most of the establishments are outside the walls of the old city, and the workpeople include many from the country around and even from Florence. H. J. F.

American Geography: Inventory and Prospect. P. E. James and C. F. Jones (eds.). xii + 590 pp. New York: Syracuse University Press. 1954. $6.00.

The editors of this book, published in the year when the Association of American Geographers was half-a-century old, have sought to "bring together the experiences of modern American geographic research to provide guideposts for the decades ahead." A short introduction on the Field of Geography is followed by useful chapters considering three basic processes known to geographers—field techniques,

air photo interpretation and cartography—and by no less than 22 chapters describing progress in different branches of the subject. To these are attached bibliographies which, with a total of 1,350 entries, form a valuable reference list of American geographical work.

Since each of the 26 chapters is the work of a different group of scholars, the treatment varies markedly through the book, like the usefulness of individual chapters to the non-American reader. On the one hand, there are a few chapters which represent a substantive contribution to thought within the field (notably that on political geography), or a valuable survey of its development, such as that on historical geography. On the other hand, some chapters are little more than annotated book lists of the American literature. This is probably a result of excessive fragmentation—how many English readers could guess even a dozen of the 22 listed parts of their field? While the editors insist that these parts do not represent "definite divisions," but only spheres in which geography have been working, it seems a little disappointing that, with such a wealth of talent deployed, the prospect for American geography should be forecast in such piecemeal fashion.

J. H. P.

The North American Midwest. A Regional Geography. J. H. Garland (ed.). 20 × 26 cm. 252 pp. New York: John Wiley & Sons Inc. London: Chapman and Hall Ltd. 1956. 64s.

This book, which is as notable for the tidiness of its arrangement as for that of its cartography, supplies a great deal of up-to-date information about the Middle West. It consists of topical and regional parts, and is the work of a number of geographers well known for their work on the area. Its publication gives geographical recognition to one of the great realities of American life, and even suggests some answers to the ever-difficult problem of where the Middle West begins and ends.

On these counts, the book fulfils a valuable function. But it nevertheless leaves the reader dissatisfied. The Midwestern landscape is now so familiar to Americans that the authors of this book have concentrated largely on the results of statistical studies, based on the Census of Agriculture or Manufactures, of the type which Professor Weaver's work has made familiar. The effect produced is too often lifeless; it is as if the geographer's "eye for country" has been given statistical blinkers, and the fascinating, if flat, Midwestern landscape reduced to patches of variously spotted zippatone. Let the reader by all means obtain here his information, but then let him return, say, to Hutton's *Midwest at Noon* to remind himself that the landscape is full of life as well as of statistics.

J. H. P.

Arctic Wilderness. R. Marshall. 15 × 23·5 cm. xxvi + 171 pp. London: Cambridge University Press. 1956. 28s.

The continuous flow of polar and sub-polar literature presents an embarrassment in choice of entertainment and information. "High Latituders" will not be disappointed by this contribution. It stands in memory of its author. In a short life Robert Marshall combined his research and administration with a delight in the Wilderness he appears to have made his own. Reconnaissance mapping and forest investigation especially at the northern margins took him into the Brooks Range of arctic Alaska. But his travels were occasions for aesthetic recreation; his dedicated advocacy of the value of a pristine landscape for this purpose is amply demonstrated; its increasing significance under the threat of population and exploitation is perhaps not widely understood. Nor do we sufficiently consider the value of a ration of atavism.

In the book an outline of Marshall's life and hopes is followed by his account of journeys north from the pioneer settlements on the upper Koyukuk past the outlying mines and trappers' cabins through empty valleys leading to the Arctic Divide.

Such journeys had not epic or saga magnitude, rather were they hard treks; the penetrations were not comparable with finding new Karakorum passes nor could his mountain ascents approach that scale. But his exploration had the nice balance of increasing knowledge of a large block of country with great enjoyment.

To description of landscape is added appreciation of trapper, miner and Eskimo who blend with their background. The several modes of travel are all touched upon. The writing is unpretentious yet often vivid and evocative with perhaps the rare hyperbole. Attractive photographs help to justify the recurring expression of surprise and wonder in this tastefully produced book. R. C.

The Colonies in Pictures. (3rd edition.) Colonial Office and Central Office of Information. 19 × 14 cm. 104 pp. London: H.M.S.O. 1956. 3s.

The Colonial Office, in collaboration with the Central Office of Information, has prepared a revised version of this booklet which includes many new photographs. The booklet illustrates aspects of the lives of the 80,000,000 people differing greatly in race, colour and creed who live in the Colonial Territories. Its sections deal with the Colonies region by region, using location maps to supplement photographs; problems of the Colonies created by disease, poverty and ignorance, and how these are being tackled; and the policy of transferring power of government to Colonial peoples. A two-page table summarizes facts and figures about the Colonies. Many of the photographs are simply of social significance, but there are several which would provide valuable illustrations in teaching geography; for instance those of an ox-cart loading with sugar cane in Mauritius, a West African coastal swamp, Malayan "secondary" jungle, soil erosion in Onitsha Province, Nigeria and a "pagan" village on the Bauchi plateau in Northern Nigeria. The booklet could usefully be added to a teacher's collection of illustrative material. M. O.

Interrelations of Cultures. Unesco. 23 × 13 cm. 387 pp. Unesco: 19, Avenue Kleber, Paris 16. 1954. 14s. 6d.

The thoughts in this interesting collection of essays would make *Diversities* of Cultures a more fitting title. The introduction treats too much of Greek thought and its derivatives in the European tradition and neglects non-European philosophies. The essay on China is finely literary and looks upon folk life as the main origin of literature and of effective movements of thought. The written language overrides dialect boundaries but is (cf. Latin) the possession of a small educated class. Its long dominance has prevented the rise of nationalisms in Chinese regions, whereas the rise of vernaculars to literary status in Europe has been an outstanding influence in nationalist politics. The author hardly mentions the diversities of environment and the mighty influence of the mud plains of Hwangho and Yangtse. The Japan chapter enlarges on Chinese influences in the past and Euro-American influences since the Meiji revolution; it is mainly a chronological summary and, like the Chinese chapter, neglects environmental factors such as the Inland Sea, the old frontier on Lake Biwa and the long struggle northward on a narrow front to subdue pre-Yamato peoples. Of the three essays on India, one gives a fair summary of ethnological chronology, the others idealize Indian culture and claim that it is totalitarian in an inclusive sense and thus contrasts with totalitarianism in European religion and politics which is apt to be exclusive and therefore separatist. It is claimed that the absence of a chronological historical sense restrains the hardening of internal divisions. Modern contacts are thought to have been hostile to Indian art. The influence of environments is, again, almost ignored.

A short essay on U.S.A. seems hardly worthwhile in view of the vast importance of that region's influence on life the world over. Four studies of Spanish culture do at least mention environmental factors and discuss historical cultural relations of Latin America with Spain and France as well as modern relations with North American life and thought.

Two essays plead for a better effort to appreciate negro art and thought. West African sculpture often selects the front, back and side views of the figure depicted, rather than a naturalism in bodily proportions, but the essays hardly make enough of the more naturalistic art of Ife. Europe is rightly criticized for attempting to force its value-judgments on African peoples, too often in the interests of a hurried economic development. H. J. F.

Trail Guide to the North Country, Yosemite National Park. L. W. Clark. 49 pp. Stanford Univ. Press, California. London: Geoffrey Cumberlege. 1954. 15s.

Argentina. G. Pendle. 159 pp. London: Royal Institute of International Affairs. 1955. 12s. 5d. This book, which has a short geographical introduction, includes an interpretation of the insurrections of 1955, and an extensive bibliography.

Bolivia. A Land Divided. H. Osborne. 144 pp. London: Royal Institute of International Affairs. 1954. 12s. 6d. Includes a descriptive survey of the country and a bibliography.

Ecuador. Country of Contrasts. L. Linke. 173 pp. London: Royal Insitute of International Affairs. 1954. 13s. 6d. After a brief geographical introduction, emphasis is placed on social aspects of the country.

Paraguay. A Riverside Nation. G. Pendle. 115 pp. London: Royal Institute of International Affairs. 1954. 10s. 6d. Includes useful chapters on the economic geography of the country.

As sucessivas faunas de mamíferos terrestres no Continento Americano. C. de P. Couto. 159 pp. Rio de Janeiro: Museu Nacional Publicações Avulsas No. 11.

Amazon Head-Hunters. L. Cotlow. 208 pp. London: Robert Hale. 1954. 18s. Exploration in the country of the Jivaro head-hunters.

Bliss in Bali. The Island of Taboos. J. Chegaray. 200 pp. London: Arthur Barker. 1955. 18s.

Geographic Regions of New Zealand. Post-Primary School Bulletins published by New Zealand Education Department. Booklets of 20 to 30 pp. by various authors, giving useful and authoritative regional descriptions of the following: Northland–Coromandel Region: Canterbury–North Otago Region; Volcanic Plateau, North Island; Nelson–Marlborough Region; Taranaki–Manawatu Region; Westland Region; Southland–East Otago Region: South Auckland Region; High Country Region, South Island. Illustrated with maps, diagrams and photographs.

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